Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

NOLOGY DEPT
n.192

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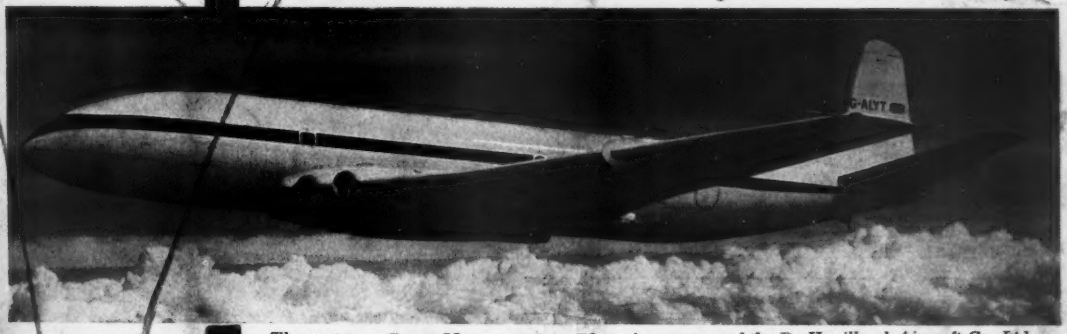
I.C.I. PLASTICS

Serve the Aircraft Industry



The prototype Comet II. *Photo. by courtesy of the De Havilland Aircraft Co., Ltd.*

There are few British aircraft in which I.C.I. plastics are not used somewhere, whether it be in the manufacture of radomes for night fighters, or p.v.c. fabric for the interior decoration of new airliners. I.C.I. Plastics have contributed much to the success of the De Havilland Comet—the world's first jet airliner.

The plastics widely used in this aircraft are:

'NURON'—low pressure contact laminating resin used with glass cloth in the fabrication of large and small ventilation pipes, fume ducts, wing tips, fan casings, etc.

Advantages: simple and inexpensive fabrication, low weight of mouldings, toughness.

'PERSPEX'—acrylic sheet for pressurised cabin windows (including inner framing), lighting fittings, toilet fitments, accessories, etc.

Advantages: ease of fabrication, low weight, toughness, excellent weathering properties.

'ALKATHENE'—brand of polyethylene for radar cable insulation.

Advantages: low power factor, lightness in weight, ease of extrusion.

'WELVIC'—polyvinyl chloride for electric cable insulation.

Advantages: ease of extrusion, resistance to abrasion, available in non-inflammable grades, made in a wide range of colours for easy cable identification.

'FLUON'—polytetrafluoroethylene, a special high-frequency dielectric.

Advantages: unaffected by high temperature or corrosive fluids.

'Nuron', 'Perspex', 'Alkathene', 'Welvic', and 'Fluon' are registered trade marks, the property of Imperial Chemical Industries Limited.

IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.I.

Export enquiries should be addressed to: IMPERIAL CHEMICAL INDUSTRIES LIMITED, Plastics Division, Black Fan Road, Welwyn Garden City, Herts., England.

P.533

Tri-ang RAILWAYS

Manufactured by

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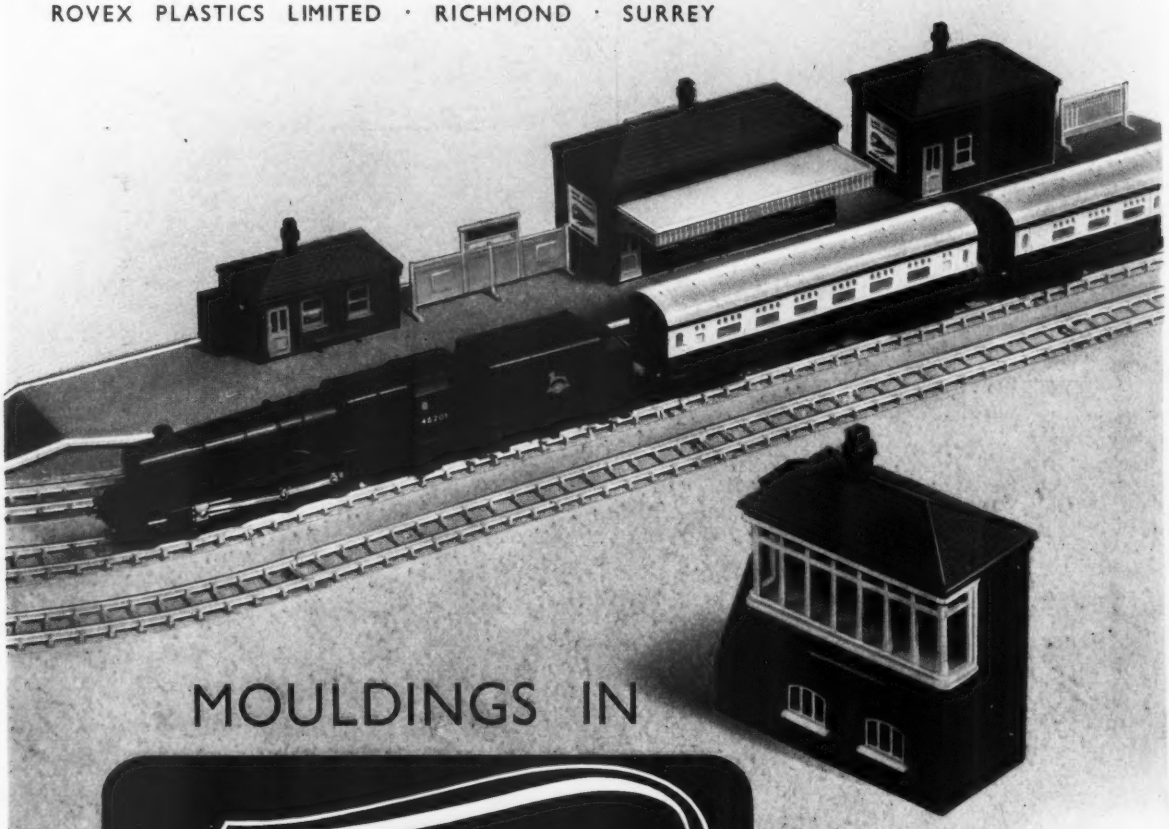

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FINISHING GRANULES
for the barrel surfacing of plastics, wood and metal parts. The granules are of porous stone impregnated with a special bonding and lubricating compound. Their use prevents formation of dust and protects the material from abrasions. The granules can be reimpregnated after a period of use.

POLISHING CREAM No. 10
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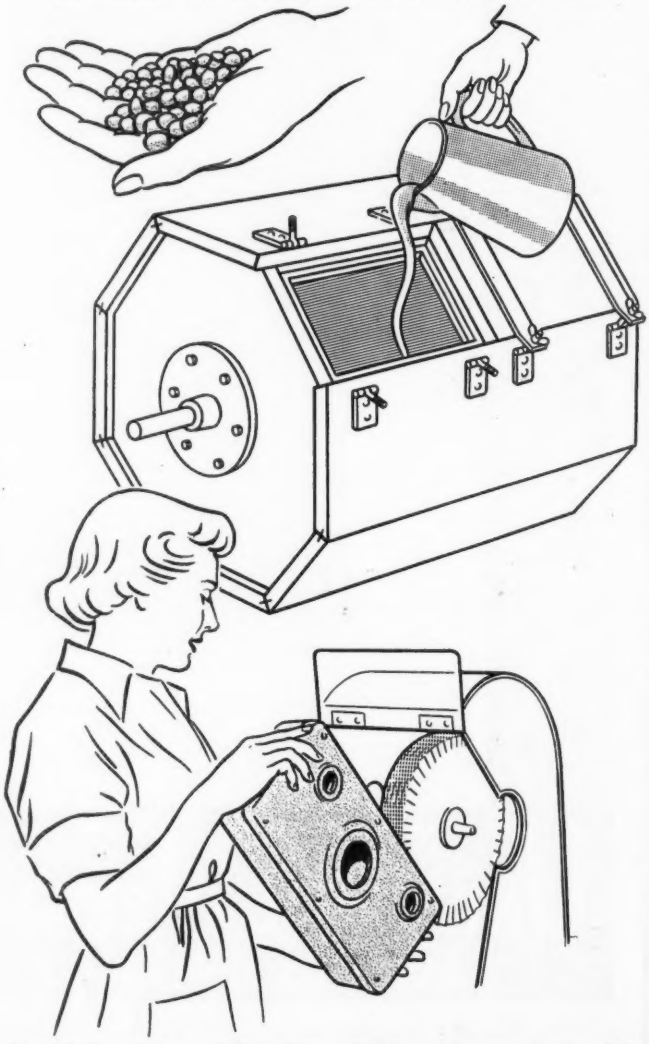

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AKULON *An outstanding nylon type material*

AKULON *An excellent construction material for gears, bearings and moving machine parts.*

AKULON
Tough abrasion resistance
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Almost noiseless in operation
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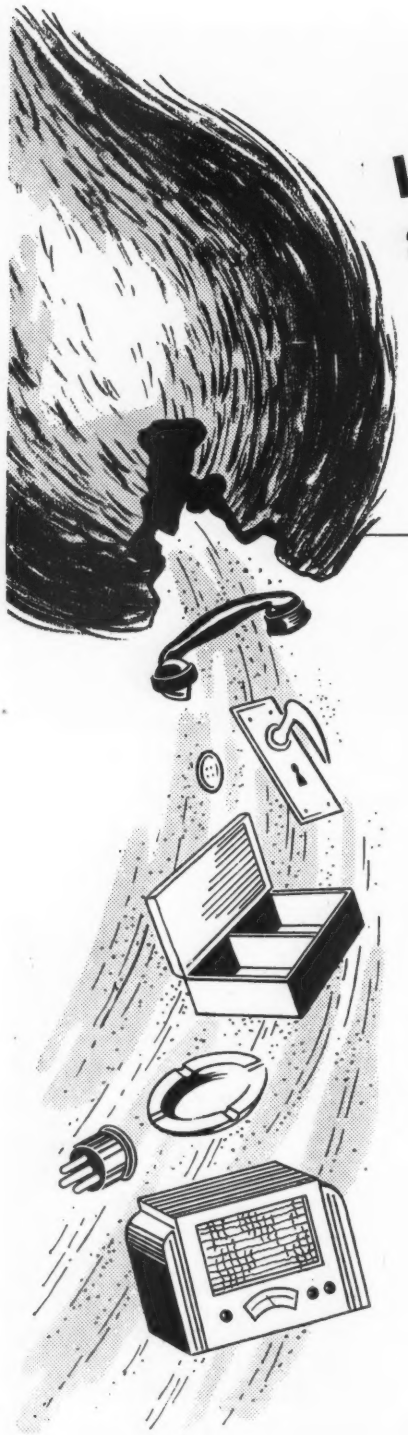

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FOR THE MOULDING POWDER MANUFACTURER

Vavanite particles have shapes which act as a mechanical strengthening aid for phenolic moulding powders. **Strength is imparted by actual chemical bond with the resin.**

Surpasses conventional fillers, giving better surface finish, improved plastic yield and electrical properties by virtue of reduction in water absorption, and greater depth of colour. Saves valuable resin, the mouldings thus assuming these very real advantages with **decreased raw material cost.**

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Assess the potentialities of Vavanite in your own moulding shop. Technical data and free samples from our Consultant : George B. E. Schueler, Plastic Research Laboratories, Greencroft Mills, Simpson Street, Hyde, Cheshire.

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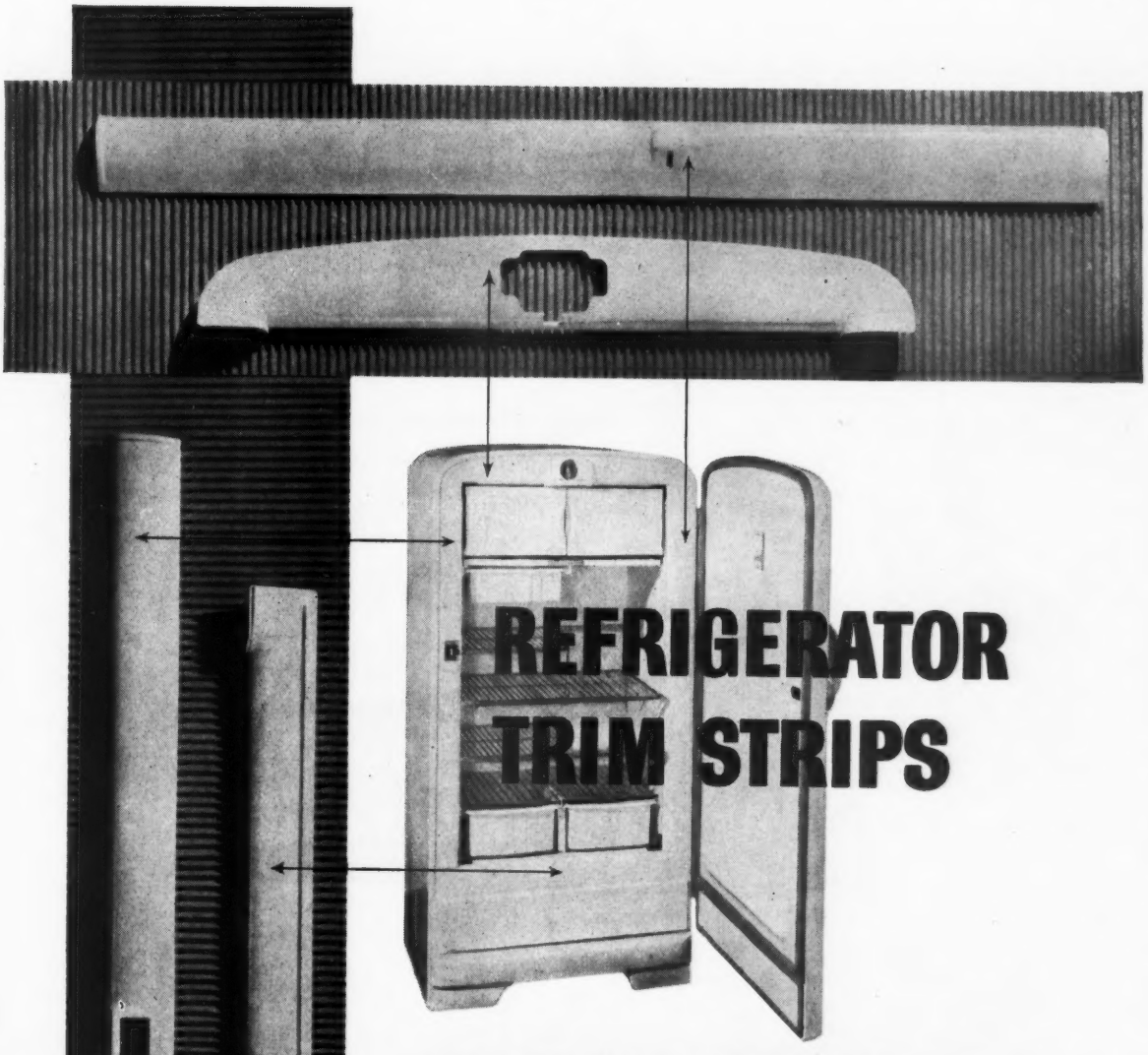

REFRIGERATOR TRIM STRIPS

MOULDED IN "DISTRENE" 200XL

"because of its toughness and robustness"

"Distrene" 200XL was chosen for the trim strips of this Coldair Refrigerator by the Witton Moulded Insulation Works of the General Electric Company Limited because of its extra toughness and practical robustness in service.

Illustrations by courtesy of General Electric Company Limited and Coldair Limited.

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POLYSTYRENE MOULDING MATERIALS

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FURFURYL ALCOHOL

An intermediate for resins which are unique in their inertness to acids, alkalis and solvents. These are recommended for the manufacture of resistant cements and moulded chemical plant. Commercial quantities available.

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Ethylene glycol, Grade S, a plasticiser for transparent cellulose film; solvent for basic dyestuffs; intermediate in the production of alkyd resins, polyesters, and other ethers and esters.

Diethylene glycol, a plasticiser; solvent for dyestuffs, gums and resins; intermediate for solvent ethers and esters.

Other products include: ACETONE, NONANOL, 'ALPHANOL' 79.

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INFORMATION FROM
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INJECTION MOULDING MACHINE

Phenomenal Demand-
Extends
Manufacturing Programme!

- 1,200 CYCLES PER HOUR
- FULLY AUTOMATIC AND FOOLPROOF
- FAST PLASTICIZING AT UNUSUALLY LOW INJECTION PRESSURE
- AUTOMATIC LUBRICATION
- 3-ZONE CYLINDER HEATING
- VICKERS-DETROIT HYDRAULIC EQUIPMENT

BRITISH MADE

EARLY DELIVERY

SPECIFICATION

MACHINE CYCLES PER HOUR (Max.)	1,200
APPROXIMATE WEIGHT OF MATERIAL PLASTICIZED PER HOUR (Dependent upon weight per shot and material used)	22 lb.
Area of Injection plunger	2·074 sq. in.
Pressure per square inch on material at end of plunger	9,100 lb.
Total pressure on Injection plunger	18,850 lb.
Mould opens (adjustable)	9 in.
Maximum die space	7 in.
Minimum die space	3 in.
Maximum recommended casting area in mould	15 sq. in.
Size of die plates	16 × 10 in.

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Polyvinyl Chloride

PRODUCTS

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FOR EXTRUSION including sheathing (dielectric and arctic grades), belting and piping.
FOR CALENDERING
FOR INJECTION MOULDING

● **VINATEX P.V.C. PASTE**
FOR LEATHERCLOTH coated paper and casting. Special grades for low temperature flexibility and non-tacky finishes. Supplied pigmented or clear.

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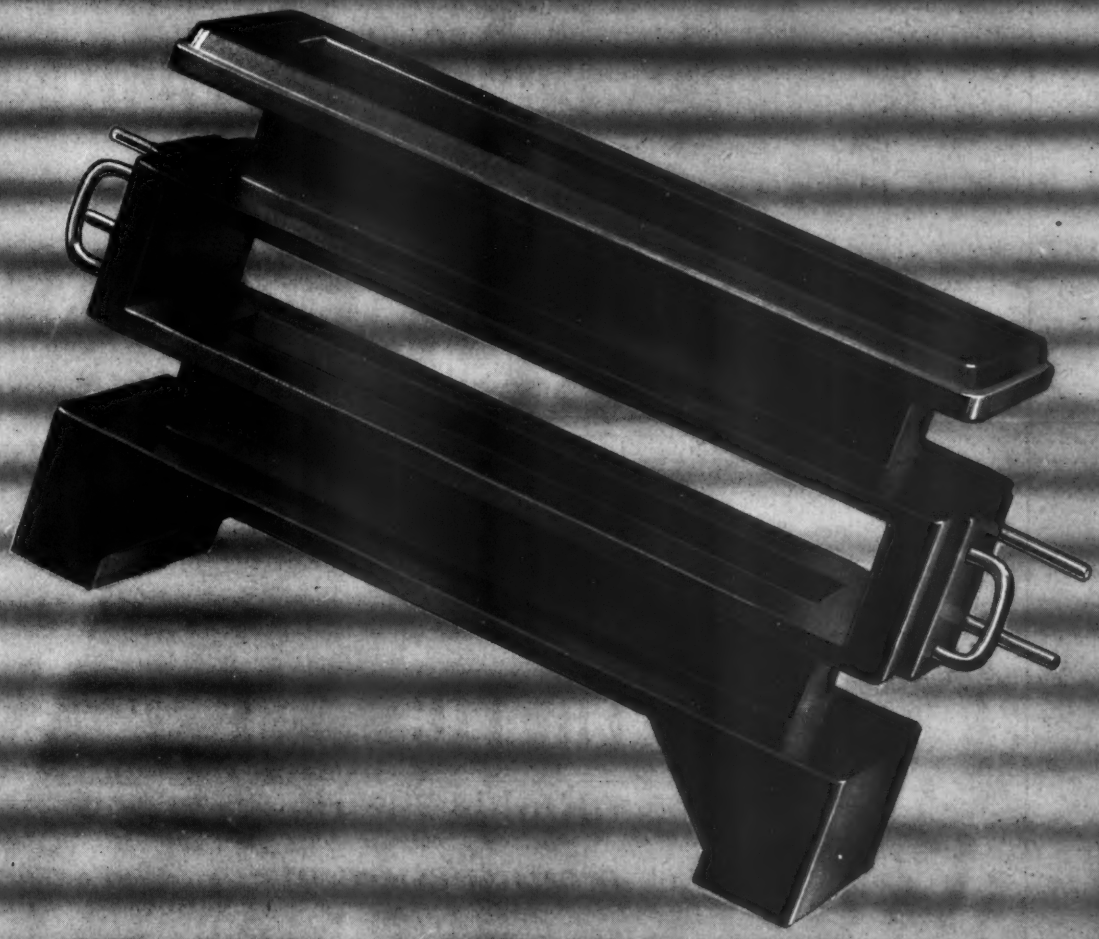

PLASTICS
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RCL

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SYNTHETIC RESINS

suitable for the manufacture of

MOULDING POWDERS

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Varnish media · Synthetic Resins & Glues
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it's no secret . . .

. . . that Mentmore Plastics have two striking advantages to offer that you need and do not usually find ; this thermo-plastic injection mouldings service is well worth a second look :

Delivery Service: *Count on this to be absolutely exceptional. We promise you the best timetable in the Plastics business—and keep to it (which is, perhaps, more surprising). Just ask us to prove it.*

Meticulous Accuracy: *We welcome orders for intricate mouldings and guarantee accuracy in all our production. However close the limits imposed we will work to them. Examples of mass-quantity with fine-limit accuracy are the millions of barrels we produce annually for Platignum Fountain Pens. May we have your inquiry or invitation to call?*

Issued by Mentmore Plastics — another* Platignum *enterprise

Mentmore Manufacturing Co., Ltd., 1 Bradley Road, Wood Green, London, N.22 Tel : Bowes Park 6021/3

Desirable Modern Residence

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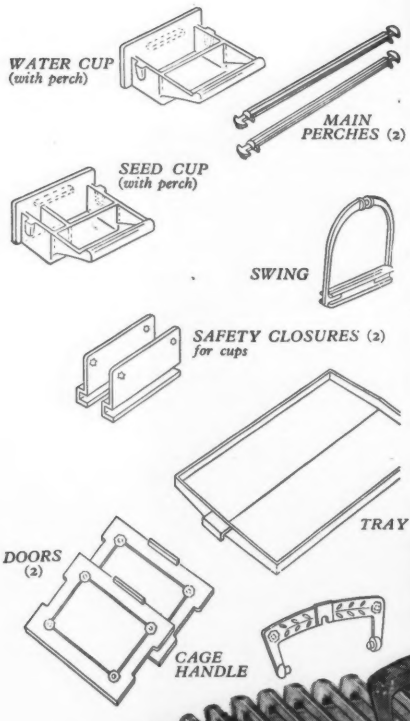


THE 'Sunnycage' is indeed a plastic palace for pet birds, a long-desired improvement in this kind of housing problem. Entrusted to Ekco Plastics, it is made in clear Polystyrene and fitted with everything necessary to the convenience of both the bird and its owner. A glance at the main shell gives some idea of the tooling involved, one half of the moulding being duplicated and chemically welded to the other. No less than 8 separate mouldings were also required to equip the cage. In any plastic problem, no matter how complicated, Ekco Plastics can give you experienced 'all-in' tooling and moulding service. The 'Sunnycage' is tooled and moulded by Ekco for Sunnytoys (Distributors) Limited, Blackpool.

EKCO plastics for industry

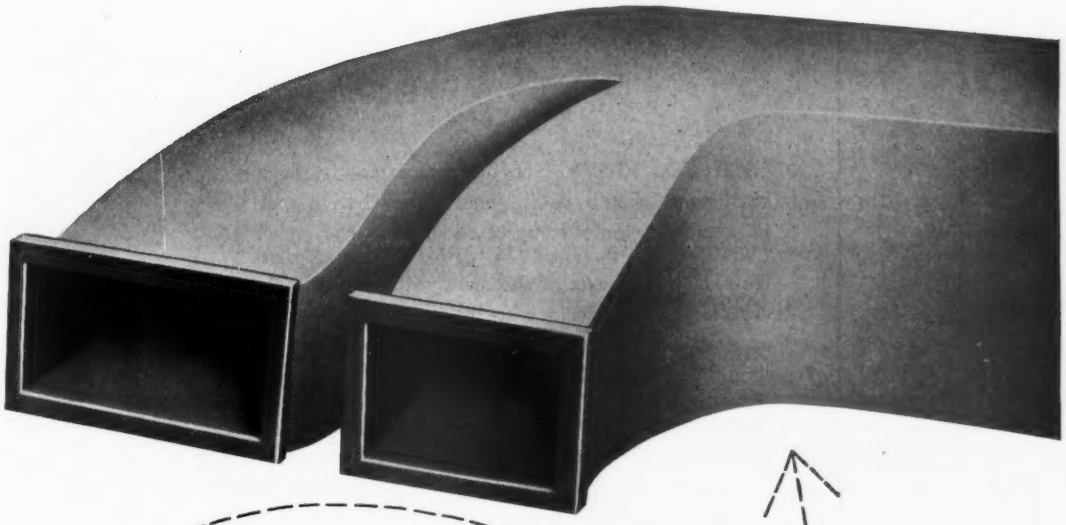
E. K. COLE LTD. (PLASTICS DIVISION), SOUTHEND-ON-SEA · ESSEX

Members of the British Plastics Federation

New resins for low-pressure laminating

Epikote Resins

offer many advantages



EPIKOTE RESINS are the reward of continual research by Shell in the resin field. Compared with other laminating resins, they are a notable advance, largely because of their excellent adhesion to glass fibre. Among other marked advantages of EPIKOTE RESINS are higher specific stiffness, improved resistance to a wide range of inorganic and organic materials and improved mechanical properties. Write for an illustrated booklet on EPIKOTE RESINS and their industrial applications.

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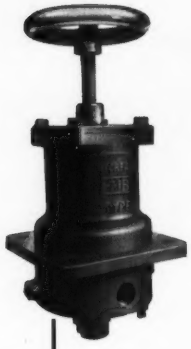

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Now, at the request of the many satisfied users of E.M.B. Presses we have decided to market a very complete line of air cylinders, speed controls, and valves, all upholding the unique reputation we have achieved.

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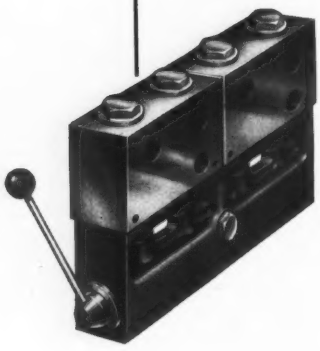

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GLASS FABRIC LAMINATES

As the leading manufacturers of glass fabric laminates in this country we specialize in the manufacture of components both as standard lines and to customers' specifications, and will be pleased to advise you on a suitable laminate for any application where strength and electrical or chemical resistance are of paramount importance.

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Moulders & Fabricators of ALL Plastic Materials

Specialists in Perspex fabrications, glass laminates and bonding of rubber to Perspex and metal, compression and injection mouldings in Bakelite, Urea, Formaldehyde, Polythene, Polystyrene, Cellulose-Acetate, etc.

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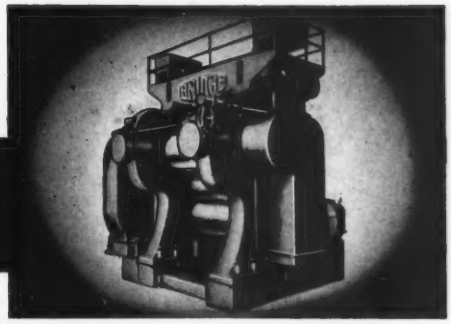
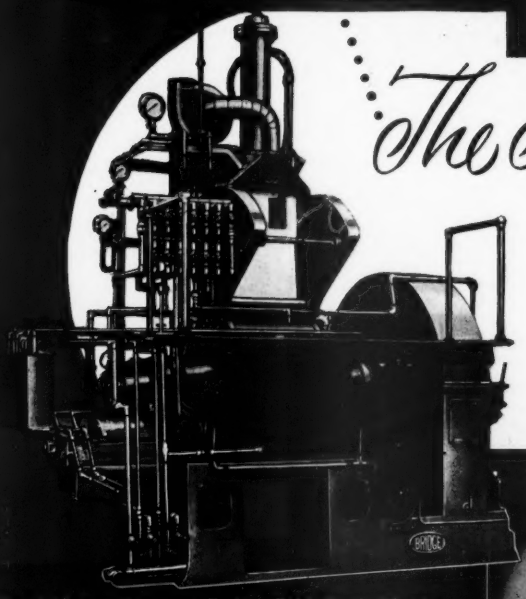


Precision Calender with three superimposed and one offset roller. Flood lubrication.

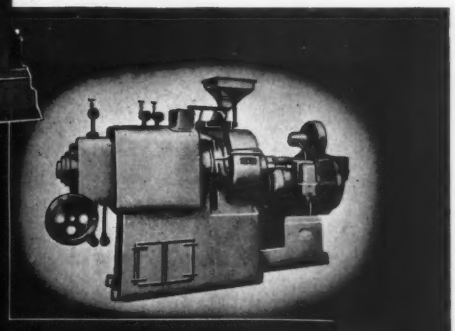
The Hallmark

of DESIGN, SERVICE and PERFORMANCE *in* **RUBBER AND PLASTICS MACHINERY**



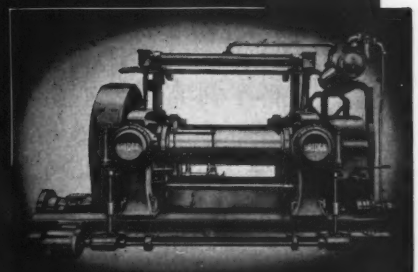
The Bridge — Banbury Patent Mixer. (1)

Precision Calender with four superimposed rollers. Flood lubrication. (2)

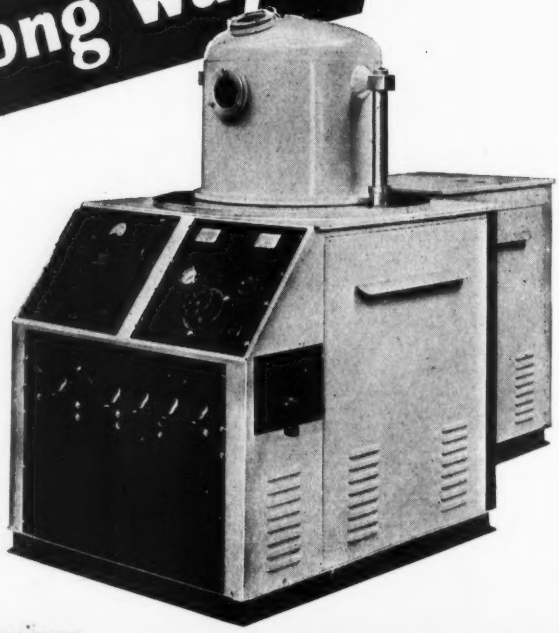


4½" Cold Feed Plastics Extruder. (3)

High temperature 22" x 60" Plastics Mill with flood lubrication. (4)



Is it true that a little goes a very long way?



Yes, we can prove it with a V.I.A. Vacuum Coating Plant. 1-lb. ONLY of aluminium (or other metal if required) can cover more than 3,000,000 metal or plastic objects each one inch square. Plastic Manufacturers can conserve scarce or expensive metals by the use of the Vacuum Coating Process without detriment to the resultant appearance.

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High Vacuum Engineering
Pumps, Valves, Gauges
V.I.A.

Saved---

by ROOTES

Hats off to PRESSED STEEL CO. LTD. for the brilliant idea of distributing Money Boxes in the shape of Prestcold Refrigerators. Hats off, too, to the designers at ROOTES MOULDINGS LTD. who had the job of moulding them in white plastic. Because public demand proved greater than expected, production had to be stepped up almost 'over-night' . . no easy task. It was here that the policy of tackling the job all under one roof proved its worth — the tools were designed and made on the spot and production went ahead without delay.

If you've a moulding problem why not pass it to ROOTES? They can save you time and money as well!

Contractors to M.O.S., *Admiralty, etc.* A.I.D. *approved*
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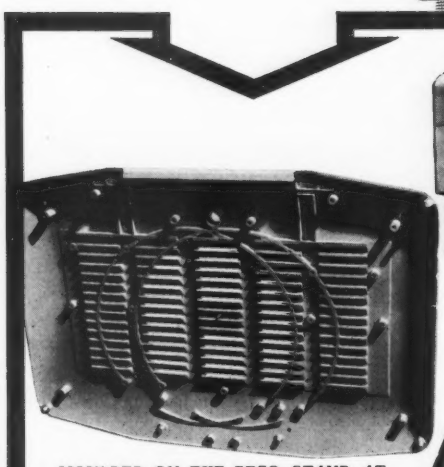
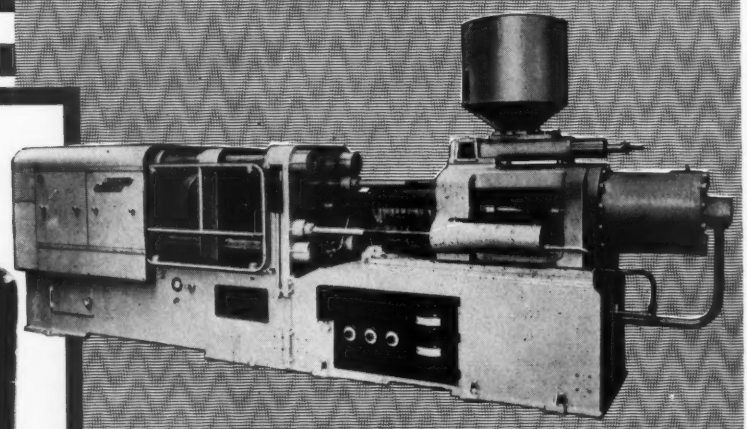
Smee's R104

facts that speak for themselves



MOULDED ON THE PECO STAND AT THE BRITISH PLASTICS EXHIBITION



PYE RADIO CABINET

WEIGHT 14 ozs.
AREA 15½ × 10⅜
MATERIAL-Polystyrene
TIME-100 secs. (approx.)

Moulded by Halex Ltd. (Industrial Division) for PYE Ltd.
Pin-gated Mould by Minerva Engineering Co. Ltd.

PYE RADIO RECEIVER COMPLETE

The design and proved performance of PECO Injection Moulding Machines result in the production of plastic articles of the widest range, from simple domestic goods to intricate mouldings such as this Radio Cabinet illustrated. Always these machines give the same perfect, undeviating production flow. Do you ask for impartial recommendation? It comes from the manufacturers all over the world who have installed them. *Illustrated literature describing the full range of PECO machines will be sent on request.*

MOULDS

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The PROJECTILE & ENGINEERING COMPANY LIMITED

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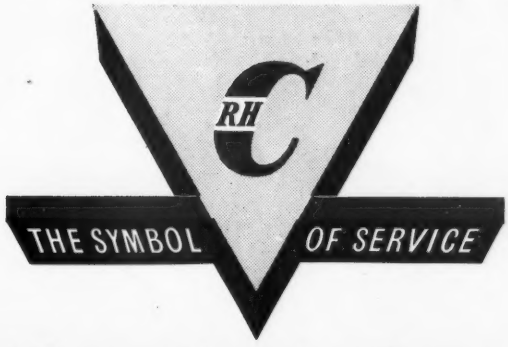
R.H.C. PRODUCTS



A Most Comprehensive Range of Raw Materials for the Plastics Industry

As Specialists of long standing in raw materials for Plastics we feel the time has come to list briefly our range of products. The range, always comprehensive, has increased recently to a remarkable extent in pace with the latest technical developments.

STYRON 475 SHEETING	For forming by conventional methods.	**RHC POLYSTYRENE MOULDING GRANULES**	For injection and compression moulding and extrusion.
STYRON **666 General Purpose** **777 Medium Impact** **475 High Impact** **700 Heat Resistant** **637 Light Stabilised**	For injection and compression moulding and extrusion.	**ADHESIVES**	For Plastics.
		STYRENE MONOMER	Glass clear. light stable. Heat sensitive. For Po.ymerisation in the manufacture of plastics, laminating and sealing compounds, co-polymers, etc.
CELLULOSE ACETATE MOULDING POWDER	In a range of colours for injection moulding.	**CELLULOSE ACETATE FLAKE**	For the manufacture of moulding powders, lacquers, strippers, foils and sheeting.
METHYL METHACRYLATE POLYMERS & MONOMER	Glass clear, light stable inert. For surface coatings and dental purposes.	**POLYAMIDE MOULDING COMPOUNDS**	For injection and extrusion.
		POLYURETHANE MOULDING COMPOUNDS	For extrusion and injection for articles having high mechanical qualities.
VINYL CHLORIDE POLYMERS AND CO-POLYMERS	Compounds for calendering, injection and extrusion.		
CELLULOSE ACETATE BUTYRATE MOULDING COMPOUNDS	Injection and extrusion.	**ACETO BUTYRATE FOIL (ELECTRICAL INSULATING)**	For cable and wire wrapping. Insulating.
TRIFLUORO-MONO-CHLORO ETHYLENE (Fluorinated high Polymer Hydrocarbons)	Moulded goods. For high electrical properties, chemical resistance, etc.	**POLYESTER RESINS (COLD SETTING AND HEAT HARDENING TYPES)**	For impregnating glass fabrics, potted circuits, etc.
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		THERMOCHROM CRAYONS (TEMPERATURE INDICATORS)	Temperature indicators for machinery heating systems, etc. Rapid and distinct colour change.
PHENOL FORMALDEHYDE & UREA FORMALDEHYDE THERMOSETTING MOULDING COMPOUNDS	For compression and transfer moulding.	**THERMOCOLOUR POWDERS**	Uses as above. Soluble in industrial methylated spirit.

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So you're doing us a *favour* by bringing to us your problems and difficulties. Together we'll follow them through in the way that's worked so well, so often, before.

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means everything in thermoplastics

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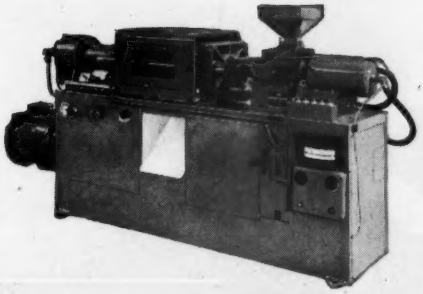
S.H.1

automatic injection moulding machine



The latest of our famous range, will mould articles up to 1-oz. capacity at 20,000 p.s.i. or articles up to 2-ozs. with an additional plunger and liner at 13,000 p.s.i. The control gear for the automatic cycle is completely mechanical, no electrical apparatus being used. This ensures a lasting and trouble-free control system.

Write for descriptive literature giving full specifications of both machines.

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S.H.2

fast cycling hand operated injection moulding machine

Completely self-contained, as the 1-oz. fully automatic machine, of 2-oz. capacity at 13,000 p.s.i. The hydraulic pump is driven by a 7½ h.p. motor and the direct hydraulic lock exerts a force of 30 tons. The injection assembly is based on the well-known Windsor retraction unit system.

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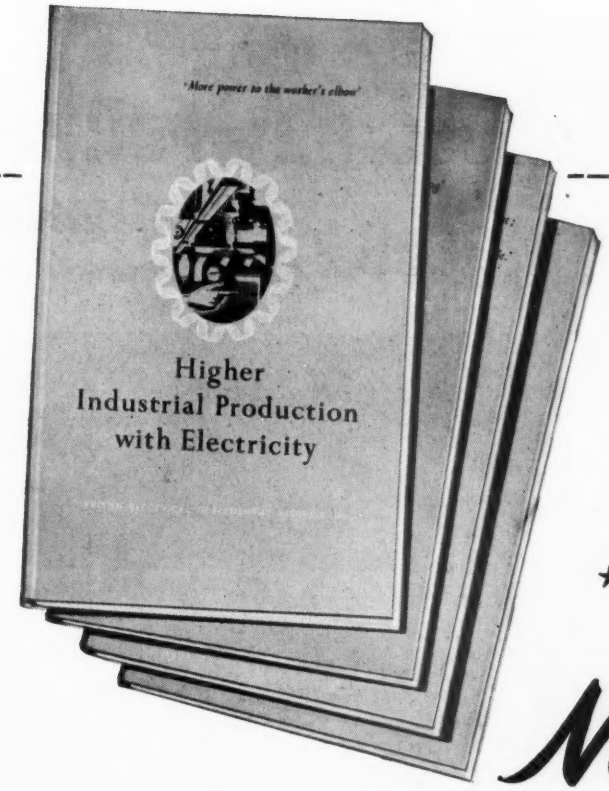

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PRODUCTIVITY is one of the vital problems affecting Britain today. One way to increase productivity is to put POWER at a man's disposal; and the best way to do this is with electricity.

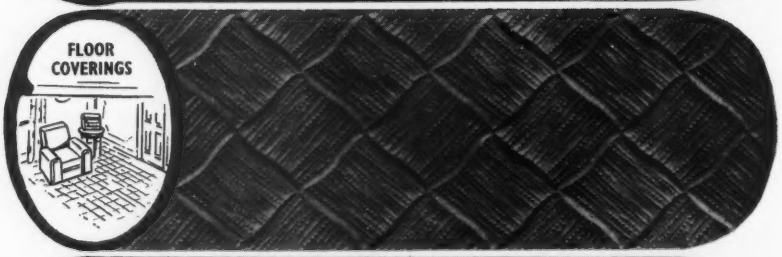
As a contribution to the solution of this problem, the British Electrical Development Association is now publishing a new series of books for management and executives in Industry. The first four are now available: "Higher Industrial Production with Electricity" describes a wide variety of modern production methods; "Lighting in Industry" shows how lighting can affect individual output, how its effectiveness can be assessed, and how improvements can be made; "Materials Handling in Industry" shows the way to increased productivity by improved handling; and "Electric Resistance Heating" indicates where, and how, this unique method of producing heat without combustion can be applied.

The post-free price of each of the books is 9/- and copies can be obtained from the British Electrical Development Association, 2 Savoy Hill, London, W.C.2, or from your Electricity Board.

The Association has produced a film called "A Case for Handling" which illustrates by practical demonstration the vital part that improved materials handling can play in all industries. It runs for 32 minutes, and is available on free loan.

Electricity for PRODUCTIVITY

Embossing rollers & plates *for leathercloths, plastics, leathers.*



We specialise in embossing rollers and plates for leather goods. Manufactured in steel and other metals. Also rollers for embossing Wallpaper, Writing and Fancy papers, Box Covers, Catalogue Covers, Aluminium Foil, Rubber, Fibre Board, Bookcloth... and copper printing rollers for textiles.

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"Not the weather, surely, Mr. Downs."

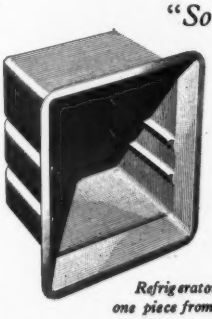
"*No, I refer to our latest achievement in plastic refrigerator interiors.*"

"You shouldn't mention the word 'warm' when talking about refrigerators, Mr. Downs."

"*Oh, indeed I should. The new interior 18" x 12" x 12" is the hottest job we've done so far. It has the liner, the breaker frame, the shelf supports and the condensation return rib all in one moulding.*"

"Quite an amazing long speech, Mr. Downs. But plastics forever, say I."

"*So do our customers, Mr. Ash.*"



Refrigerator interior moulded in one piece from glossy white PVC.

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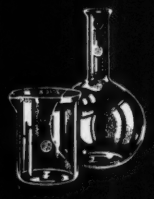
Regd. Trade Mark BRAND

Laboratory and Scientific Glassware



AN IMPORTANT ANNOUNCEMENT

FACTORY extensions and increased production facilities have made it possible to reduce the "each" price of most lines of our 'PYREX' Brand Scientific Apparatus. In addition, advantage may now be taken of a generous discount if purchasing in quantities of a dozen or more.

Your normal trade supplier will gladly furnish you with all particulars, together with a copy of our new and more comprehensive Catalogue, on request. Prompt delivery is a special feature of our improved service.

Please note that 'PYREX' Brand Laboratory and Scientific Glassware listed in our Catalogue is made only by James A. Jobling & Co. Ltd., Wear Glass Works, Sunderland, to whom you are asked to write in case of any difficulty of supply.

TWO EXAMPLES OF OUR NEW PRICE RANGE:

Example 1.

No. 2500. Flat Bottom Flask 250 ml. with B24 "*GRIP SEAL*" interchangeable ground Socket. Price each, 6/-: Per doz. 64/10 6 doz. or over, per doz. 60/-

Previous price, each 6/8

Example 2.

No. 3200. Measuring Cylinder, 100 ml. Price each, 7/8 Per doz. 82/10 6 doz. or over, per doz. 76/8

Previous price, each 8/4

Special Apparatus

We can fabricate glassware to your own design, made to serve your specific purpose, and we welcome your enquiries.

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JAMES A. JOBLING & CO. LTD.

Wear Glass Works Sunderland

The original and only makers of 'PYREX' Brand Glass in the United Kingdom.

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Did you know? . . .

- That we produce approx. 1 million mouldings every week . . .

- That we design and manufacture all our own tools . . .

- That we maintain a high standard of inspection . . .

- We have experience of all types of mouldings and moulding powders and our tool-room capacity is one of the largest in East Anglia. You can count on us to give you every assistance in the design and development of your products whether they be Compression, Injection or Transfer mouldings.

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So he threw it out of the window!

Illustrated by kind permission of Stabel Products Ltd., Burnsall Road, Canley, Coventry.

The Cotton Industry was crying out for bobbins. But the wooden bobbin flanges had to be hand turned. Suitable timber was in short supply and, owing to its combustible properties, presented a great temptation during the fuel shortage! Something had to be done.

Plastics, it was suggested, were too brittle, the flanges would probably break. We were consulted and decided on a flock-loaded material which would have great strength, present a perfectly smooth surface to the cotton and meet the other rigorous specifications imposed.

Imagine our chagrin when, on proudly presenting the first sample, the customer looked at it, picked it up and threw it out of his first-floor window, down into the yard below! We soon saw his point for, when retrieved, it was in perfect condition—obviously fit for the job. The result, a handsome order, another satisfied customer and a further problem solved.

If you have a problem and think that plastics could solve it don't give up until you have seen us. Better still, contact us first. Our 30 years' experience as one of the largest independent plastic moulders is at your disposal. Fabrication and assembly services available if desired.

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THE MOULDERS WITH THE ENGINEERING BACKGROUND

One of the three bays in our Compression Moulding Shop

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Above, Geon PVC compound granules in preheating tray. Left, the heated granules spread ready for pressing. Below, trimming flash from the prepared record.

GEON PVC MAKES HISTORY!

BBC RECORDINGS IN GEON PVC CARRY THE CORONATION STORY TO THE WORLD

The Coronation ceremony and commentaries, recorded by the B.B.C. Transcription Service and transferred to 16″ records made with Geon PVC, were flown to all parts of the world within a few hours of the ceremony.

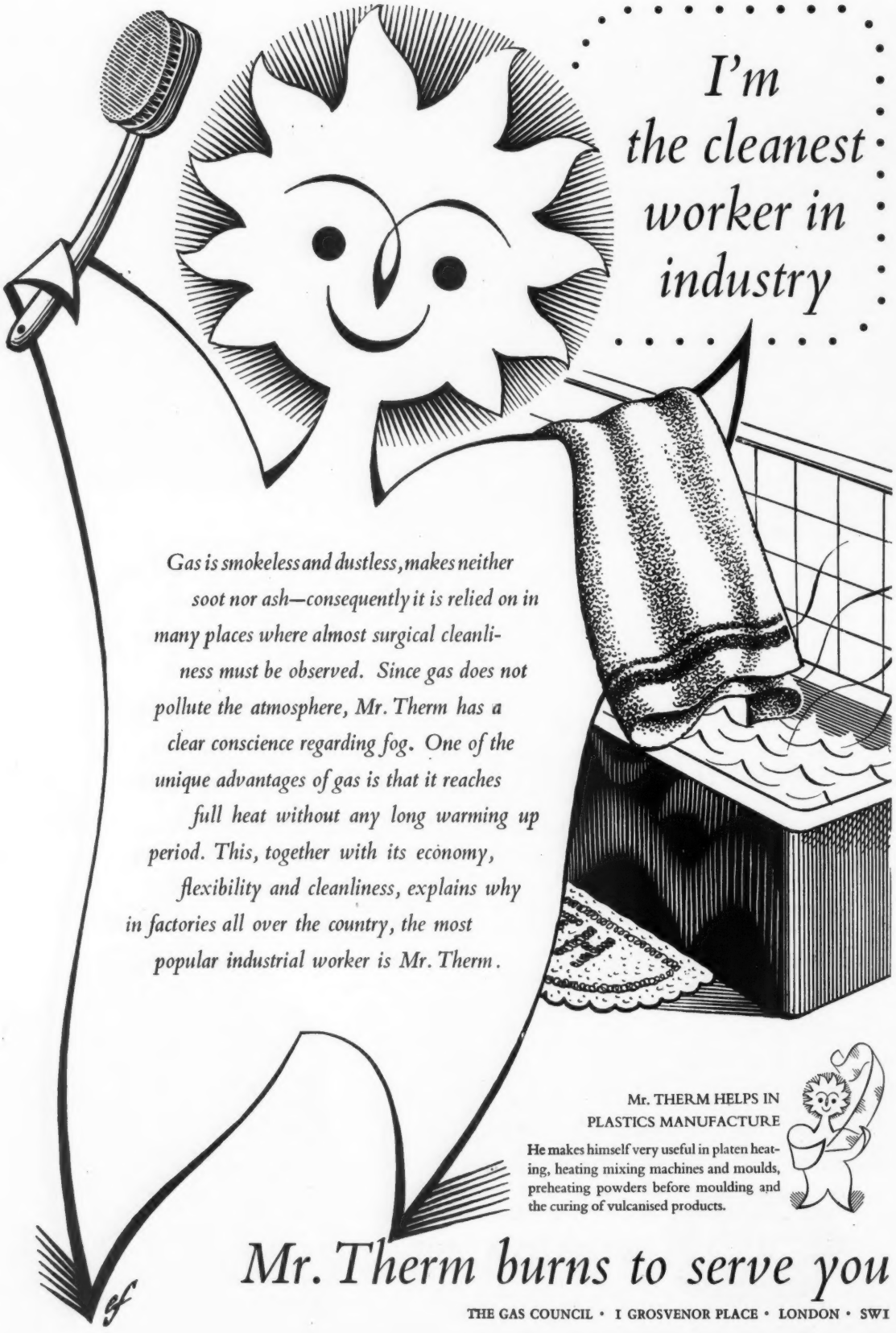
Photographs by courtesy of the Transcription Manufacturing and Recording Company Limited, in whose works they were taken, showing Coronation records being made.

Geon PVC is used — both for transcription services and long-playing records — because *only* this plastics raw material provides the phenomenal moulding accuracy required combined with dimensional stability, low background noise, accurate reproduction and tone qualities. Please write for Geon Technical Bulletin No. G.14/51 which describes the properties and processing of Geon gramophone record moulding materials.

Geon Polyvinyl Materials

BRITISH GEON LIMITED

Sales & Technical Service: 21 St. James's Square · London S·W·1 · *Telephone: Whitehall 9561* · *"Geon" is a Reg'd. Trade Mark*



I'm the cleanest worker in industry

Gas is smokeless and dustless, makes neither soot nor ash—consequently it is relied on in many places where almost surgical cleanliness must be observed. Since gas does not pollute the atmosphere, Mr. Therm has a clear conscience regarding fog. One of the unique advantages of gas is that it reaches full heat without any long warming up period. This, together with its economy, flexibility and cleanliness, explains why in factories all over the country, the most popular industrial worker is Mr. Therm.

Mr. THERM HELPS IN PLASTICS MANUFACTURE

He makes himself very useful in platen heating, heating mixing machines and moulds, preheating powders before moulding and the curing of vulcanised products.

Mr. Therm burns to serve you

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Shock-Proof

It certainly was not the fault of Venus, poor girl, that the ocean nymphs who had cared for and educated her in the warm depths of the Mediterranean, decided to "bring her out" suddenly on the surface, clad only in her birthday suit.

It was a high shock for her—particularly when, as depicted in that famous picture "The Birth of Venus," little winged cupids blew on her, chilling her yet further. An unkind thing to do.

So, Gentlemen, we will not depict that! Rather we prefer to illustrate how Zephyrus, the soft South Wind, weaved his warm mists around her to protect both her and beholders of the event from all types of Shock—high, medium and otherwise, thereby hoping we shall merit the approval of Censors and all *respectable* people.

★ ★ ★

Today the human race is becoming inured to shocks. Plastic Mouldings need equal protection. Hence the very complete range of "Nestorite" Powders, of which we append a typical example.

NESTORITE MEDIUM SHOCK GRADE A.645

Filler	Cotton
Particle Size (inches)	$\frac{3}{8}$ flake
Specific Gravity	1·37
Bulk Factor	3·0-3·9
Powder Density	·35-·45
Time of Cure of Test Cup (secs.)	55-60
Recommended Flow Range	10-18
Shrinkage (thou./inch)	5·0-6·5
Flowability (cm.)	8-9
Impact Strength (ft./lb.)	·27-·37
Tensile Strength (lb./sq. in.)	6,000-8,000
Water absorption (7 days) (mg.)	100-200
Plastic Yield Grading (°C.)	140
Shrinkage after heating 5 in. disc for 24 hrs. at 140°C. (thou./in.)	3·5
Electric Strength at 90°C. minute value (V/mil.)	40-80
Surface Resistivity after immersion (log$_{10}$ohms)	9·5-10·5
Volume Resistivity (as moulded) (log $_{10}$ohm cm.)	10-11
Power Factor at 10^6 c/s.	·05-·05
Permittivity at 10^6 c/s.	5·0-5·8

A fast-curing medium shock material. One of our most consistent and popular standard materials. Can be moulded into a wide range of articles by either compression or transfer.

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THE VERSATILE
PLASTIC
No need to state the virtues of polystyrene. It is accepted all over the world for its versatility . . . its adaptability. At long last the designer has been given a moulding powder reasonably free from limitations.
No need either to state the virtues of Kleestron. Enough to say it is made by Kleemann's in their new factory at Welwyn Garden City and is being sold . . . and moulded . . . and praised all over the world.
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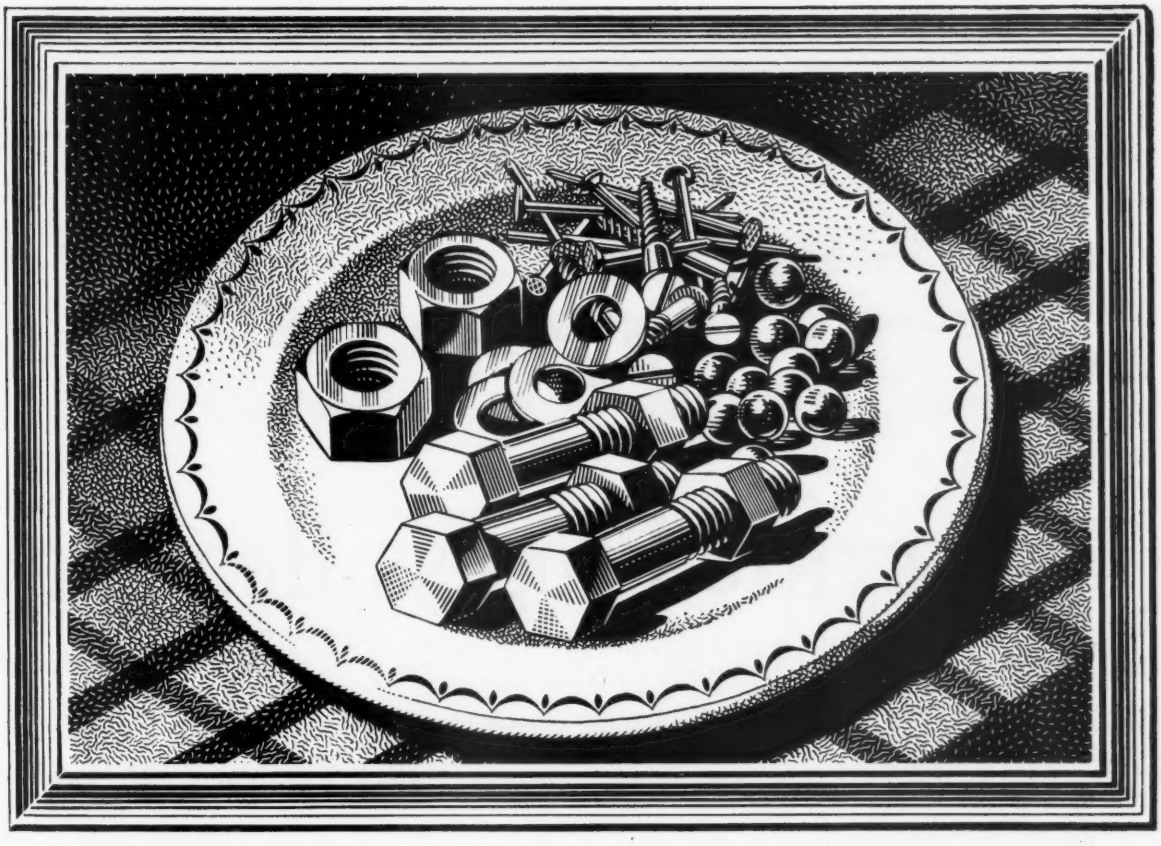

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Would you? Even though steel is no ingredient in plastic you cannot make plastic without the help of steel—steel machinery and tools. And roughly half this country's supplies of new steel are made from scrap. This scrap comes from factories like yours. Keep on turning in your scrap, and you will be doing your best to see that the plastics industry does not go short of the new steel it needs.

Obsolete machines and equipment, redundant buildings, in fact everything containing iron and steel which has outlived its effective purpose—all this is scrap and should be sent off to your local scrap merchant as soon as possible.

Search your works for it and turn it in. You will be doing yourself a great service.

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ELECTRIC Process Heating

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● Bold thinking about bigger production demands new methods of heat treatment. G.E.C. *electric* process heating ensures maximum output and true economy. The many heating equipments in its range are clean, safe, simple to operate and heat rapidly to constant, correct and controlled temperatures. Its versatility is being proved every day.

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● G.E.C. has had many years' experience in the design and construction of heating plant. The Company's specialists welcome opportunities to discuss potential uses.

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for uniform pre-heating of a mass of thermosetting plastic powder or preforms prior to pressing. Pressure moulding processes are speeded up and additional plasticity is given to the charge. This advantage is even greater where the thickness of the charge increases. Up to 1½ lbs. of plastic can be dealt with per minute, depending upon the temperature to which the material is to be preheated. G.E.C. has produced a range of high frequency power generators.

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If it's mouldable — Ebonestos can mould it

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MOULDERS IN ALL PLASTIC MATERIALS AND EBONESTOS SPECIAL COMPOSITIONS

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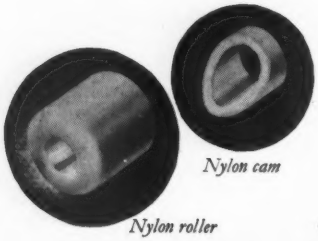
New Cross 2080 (20 lines)

An Expanding Service to Industry...

We at Fraser and Glass have grown up with industrial plastic problems for the last 30 years—and solved them so successfully that we now have one of the largest and best equipped moulding shops in Europe. Did you know, for instance, that we can now undertake *injection* mouldings up to 80 ozs.? And did you know how *many* plastic materials and processes we offer today? Here are some of them . . .



Nylon cam

Nylon roller

FRASER *and* **GLASS**

the plastics people

Materials

THERMOSETTING

Phenol Formaldehyde, Urea Formaldehyde

THERMOPLASTIC

Cellulose Acetate, Cellulose Acetate Butyrate, Polymethylmethacrylate, Polystyrene including heat resisting and high impact grades, Nylon. Flexible plastics: Polyethylene, Polyvinylchloride

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Mouldings from 1/80th oz. to 80 ozs.

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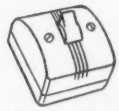
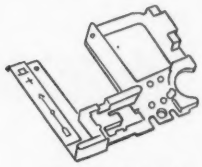


Phenolic switch



Hearing aid chassis in cellulose acetate

Polyethylene bottle

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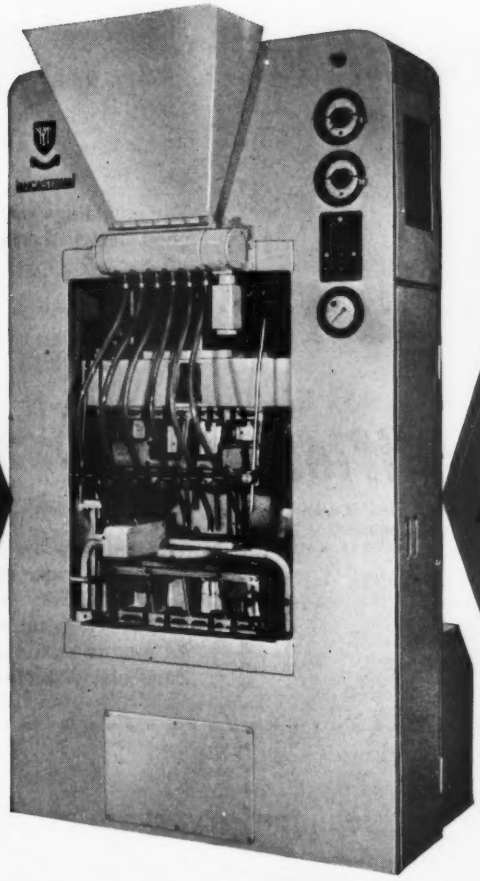
ON STAND No. A.32, AT THE BRITISH PLASTICS EXHIBITION
THE PRESS WHICH MOULDS WITHOUT OPERATOR



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This moulding Press is completely automatic from the powder measurement and feed, to the final ejection, checking of finished moulds and re-institution of the moulding cycle.

FOUNDED 1806

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FULLY AUTOMATIC
50-TON MOULDING PRESS

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WITH

High Impact STRENGTH

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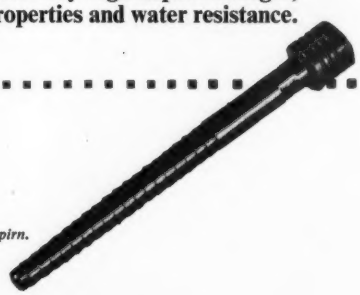
(X17352)

Base plate for fractional horse power motor, moulded by Wessex Plastics Ltd. for Newman Industries Ltd.

For mouldings with very high impact strength, good electrical properties and water resistance.

Rubber-modified phenolic
(X17181/1)



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Medium high shock resistance.
Resilience under impact.
Slight flexibility prevents cracking round heavy metal insets.
As easy to mould as General Purpose grades.
Particularly suitable for transfer moulding.

Write or telephone for samples and data

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Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

PROPRIETORS: TEMPLE PRESS LIMITED

CHAIRMAN and MANAGING DIRECTOR: ROLAND E. DANGERFIELD

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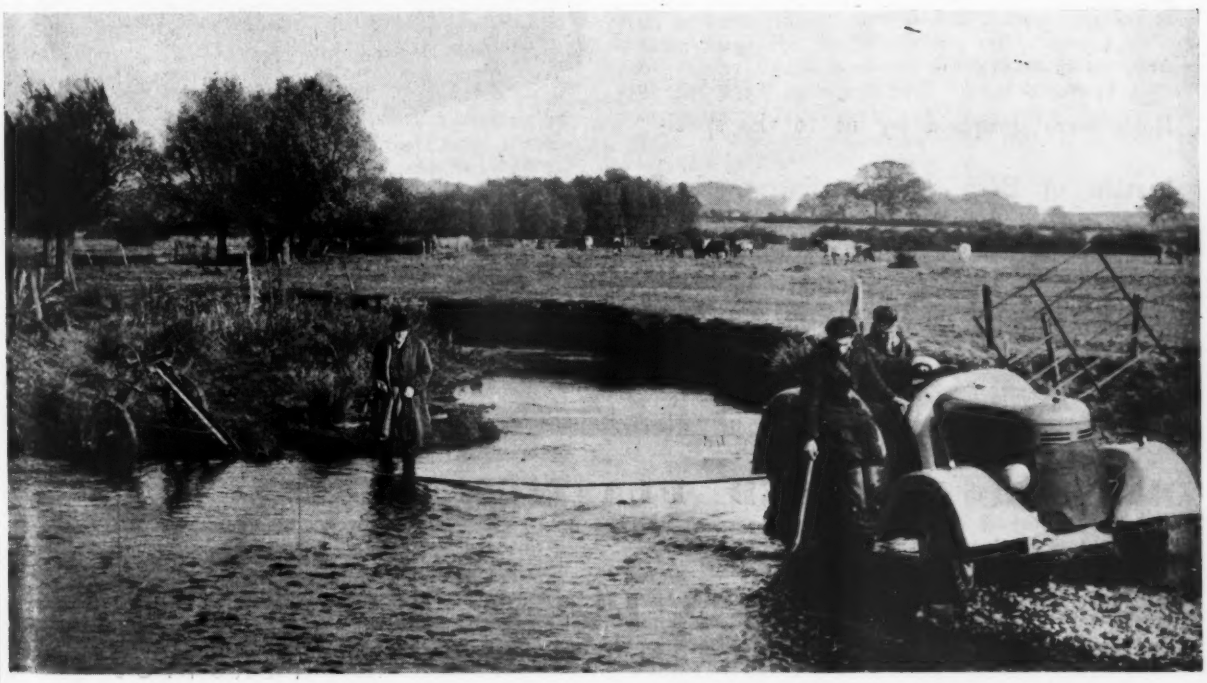
Laying polythene tubing for agricultural water supplies. Interest in plastics tubing for cold water supplies has been stimulated by the recent publication of British standards. (Photo: I.C.I.)



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Plastics

VOL. XVIII. No. 192 JULY, 1953

EDITORIALS

Success of an Exhibition

OF the success of the 1953 British Plastics Exhibition there is no doubt whatsoever and the organizers are to be congratulated on the results of their efforts to bring it about. Obviously the greatest part has been played by the exhibitors themselves: they have surpassed, without any exception, all our expectations in erecting stands and the exhibits they held were of a quality and attractiveness that has never before been attained. The sense of success which pervaded the whole atmosphere after the first few days had passed was remarkable. By this " sense of success " we mean not only our own feel of the situation, but also the very cheerful acknowledgment by almost all exhibitors that inquiries from home and from abroad were exceptionally numerous and serious. The most optimistic were the machine manufacturers, who were delighted with results, and the raw material manufacturers, but many moulders and fabricators were also pleased with increasing home inquiries. There seems no doubt that some change for the better has come over the plastics scene. We believe that the more reasoned publicity regarding our materials that has developed in the past two or three years in all journals, technical and non-technical, and the greatly improved qualities of our goods, has caused a re-assessment by the public and by industrialists. The greatly increased attendance at the exhibition may be a direct result.

The greater number of stands appeared larger in size than on previous occasions, which may have been an optical illusion. As regards the moulders' stands, we obtained a sense of space or, to put it another way, there was an absence of that " cluttering-up " of stands with innumerable past and present productions which made bygone exhibitions so open to criticism.

The spaciousness was often obtained by emphasis on a few special mouldings and in a few cases on a number of mouldings or fabrications in one field; the success of this move was on occasion very apparent. If we may be permitted an example, the method was evolved to a high degree with admirable results at the stands of Streetly Manufacturing Co., Ltd., and British Industrial Plastics, Ltd., by the " dynamic " display of melamine table and kitchen ware.

Spaciousness was not the feeling we got at the stand of Thermo-Plastics, Ltd., for it contained an amazing variety of finished goods ranging from glass-fibre structures to phenolic mouldings and from acrylic and hard p.v.c. mouldings for refrigerators to large and small mouldings and fabrications for publicity purposes. The secret of success here, and it was noteworthy, was due to the segregation of production into sectional applications, thus producing a different type of clarity. As a still more extreme type we may quote the Rosedale stand, where a myriad of toys filled the " windows " to delight the eye. Here one got no impression of over-powering crowding, for the gaze of the onlooker was carried on from toy to toy, each more ingenious, more beautiful or more amusing than the last. Obviously our theory as regards spaciousness as a desirable rule does not always hold water. Variety is still the spice of life.

As for the machinery section adjacent, it surpassed all previous efforts. It emphasized the rapid growth to semi-automatic and automatic production or the value of separate automatic controls which introduce great flexibility into the factory, the growth in size of injection machines and their new auxiliaries and displayed the machines for the latest fabricating technique—glass-fibre technology.

It was an excellent idea to make a focal point of what might be called the highlight of the plastics industry in a given year. In 1951 the Delta wing made by the Royal Aircraft Establishment formed such a highlight and this year the same general type of large structure made a distinctive separate exhibit. It comprised the Miles 30-foot glider wing and 14-foot diameter " scanner " we described in our June issue; both were made of asbestos-reinforced phenolic resin. Another exhibit here was a complete motorcar body of glass-fibre reinforced polyester resin.

While it might have been said that the number of large glass-fibre structures (car bodies, boats and tanks) on view at many stands may have overstressed the actual picture of production, yet it was a permissible exaggeration and at the least showed what can be done. It must not be forgotten that these reinforcements and those made from asbestos and phenolic resins are primarily the results of earlier work carried out specifically to produce the stiffer and stronger forms so eagerly sought by the aircraft industry and that success has been achieved with the added advantage that they are made at low pressures. There is no exaggeration of their value to the aircraft industry.

The exhibition has brought this development into the limelight as never before. It also thus focuses attention to a coming change whereby the moulding and fabricating industry must rapidly expand to absorb the development or relegate that part which deals with very large structures to aircraft manufacturers, boat-builders, motorcar manufacturers and others in structural engineering fields that surely must be swept into its orbit.

National Research

OF all the technical developments that were seen at the Exhibition, few had the exciting and tantalizing interest of the electric shock curing process shown on the stand of the Ministry of Supply. By passing an alternating current through a plastic laminate the time of cure is cut down to a few seconds. The interest lies mainly, of course, in the fact that we are presented with a new process of very high potential value, its tantalizing nature resulting from its accidental discovery and the lack of knowledge regarding the action of the electric current.

The discovery was made at the Royal Aircraft Establishment and the patent, like all others taken out by this body on plastic structures, has been assigned to the National Research Development Corporation, which has as one of its main responsibilities the commercial exploitation of inventions resulting from research carried out by Government Departments. The duty of the Corporation is to secure the working of the patents in the public interest; its practice,

therefore, is to grant industry rights to use its invention by issuing licences on a royalty basis.

The Corporation has recently issued a list of the patents covering plastic structures; in addition to that on shock moulding, they include "foaming in situ" using polyurethanes, pressureless moulding of "Durestos" sheet, new parting agents, new catalysts for polyester resins, the accelerated cure of laminates and metal film transfer to plastics.

MOULDING POWDER AND SHOT

In 1951 we published an interesting article by Mr. W. S. Penn on the production and potential value of ultrasonic waves so far as they might affect the plastics industry. Many must have wondered how they would in fact be used in practice. Today the Bendix Aviation Corpn. of Cincinnati, Ohio, U.S.A., has begun production of what must be the first instrument to measure and control instantaneously the viscosity of liquids by such means. The production of polymers is probably the most striking example in industry where viscosity changes take place very rapidly and where it is exceptionally important to control such changes. Measurement normally takes more than half an hour and by then the viscosity of the bulk batch has already changed. The new instrument, called the Ultra-Viscon, delivers results in a fraction of a second, so that it becomes a new tool of the first importance.

Control of Viscosity

◆ ◆ ◆

Having spent all my life in things chemical, petrolific and plastic, I think it's a bit thick that I should be expected to talk glibly of "seer-sucker," "gros-grain" and "silk-finish" as I had to do at the Exhibition when showing some ladies the new p.v.c. sheet styles. Blood-suckers I know something about and also "suckers" like you and me, but "seer-sucker," what on earth does it mean? If you don't know what it is, it's the stuff that makes women look as if they're covered with large goose-pimples and yet makes them appear prettier than ever. It was the star exhibit on the Storeys of Lancaster stand as curtain lengths and (this is most important) as opaque curtain. The ladies were enchanted with the design itself which was flowered in red, green, yellow on a white background, but when I told them that Storey's had pulled something big out of the bag by printing with special pigments that cannot fade under sunlight their pleasure was vastly greater.

We're all in the Fashion

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I have a friend who's a first-class metallurgist; he has often discussed with me with complete lack of bias, the question of "plastics versus metals." We often consider various jobs in plastics, and when I took him along to the British Plastics Exhibition there was quite a lot to interest him. He knew of many recent developments but opened his eyes widely at the p.v.c. and polyester large-bore tubes, the small tanks for petrol and the large water tank which rather puzzled him and many others from the economic point of view. But it was not until we went to the stands which showed the lighter side of industry that he said something very significant: "The metallurgical industry does not see much danger yet to its future from plastics because in the main it sees itself as a producer of metal structures of large size which it believes the plastics industry will never touch. On the other hand, I'm very concerned at the hundreds of nibbles I see the plastics industry taking at the foundations of the metal industry. Plastic toys are an example and a significant one, for millions of these are made. And that (he pointed to the polystyrene bird-cage on Ekco's stand) is a prize nibble. The wire bird-cage is made with two pennyworth of wire but far too many man-hours of labour. The plastic costs many times more than the wire but what saving of labour! And what sales-appeal!"

A Nibble a Day . .

◆ ◆ ◆

I've forgotten what Huckleberry Finn's cure for warts was like but he certainly had something and if he and my old great-aunt (she used to wear an old silk stocking on her left leg in bed as a preventative against right ear-ache) were alive today, they'd have made a fortune in our modern world. Still some manufacturers don't seem to be far behind in this type of research work for in an announcement about the plastics section of the 26th International Congress of Industrial Chemistry in Paris I found the exciting news that there was shown "Rhovyl, a fibre which makes garments that banish rheumatism." I have no further details so I can't tell you whether an ordinary three-piece suit or ducky pantees do the trick nor indeed if it is the vinyl fibre, the plasticizer or the stabilizer: but it's all in French Patent No. 9,560,219. Of course, as you will already have surmised, I'm not far behind in my own researches on the subject—I've made a natty polyester/glass fibre collar that I wear against severe attacks of pain in the neck (Patent Application 963,020/ZA/2).

Plastic Therapy

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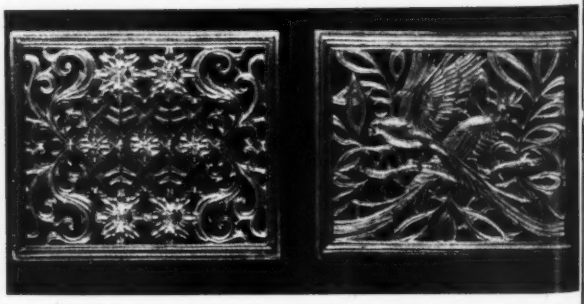
The process of metallizing plastics has forged ahead enormously during the past few years. The main applications until very recent years have obviously been in the fancy-goods field, buttons, brooches, brushbacks and so on, and it was also early applied for special units in the electrical field. New applications include the continuous metal coating of plastic film which we noted two years ago, and in the technical field, the production of "printed" electrical circuits and of motorcar reflectors. I saw another line of attack at the Paris Fair in May—for the adornment of radio cabinets—in effect as frets or decorations on frets and the cabinet itself, and as clock bodies or wall-clock surrounds. I show two examples from which will be noted the superb designs that are used. A director of the manufacturing company, Creations Maloupa, 38 Rue des Blancs-Manteaux, Paris (4), tells me that all the designs are carried out by artist-designers and that the whole is conceived purely from a metallizing point of view; the design and the moulding of the object in plastics is made to conform to the demands of metallizing and not vice versa.

Metal on Plastics

DOGSBODDY.



The National Hall, Olympia, during the Exhibition.

The British Plastics Exhibition Reviewed

The exhibition closed on June 18. Its popularity may be judged by the attendance, which was up by 20% compared with the 1951 exhibition. The Convention was also a great success, drawing as many as 550 people at a session.

SET in the midst of a city which had hung out its flags for one of the biggest occasions of the century, it was hardly surprising that the Exhibition reflected something of the gaiety and spirit of London at Coronation time. Standing up in the gallery of the National Hall, Olympia, on the day the exhibition opened, and looking across the brightly coloured stands, one sensed the note of optimism that was to be the keynote of the event. This, after the depressing year the industry has experienced generally, was indeed welcome, especially when one realizes that it was optimism born not only of the current nation-wide feeling but also of enthusiastic visitors eager for information, and many of them buyers. We understand that representatives from over 50 countries recorded their names in the Overseas Visitors Lounge.

Plastics materials are often ideally suited to attractive displays and this advantage in terms of sales appeal was consolidated by a very high level of stand design. A study of the many photographs which follow will indicate the care that was taken to construct attractive stands, mostly in the contemporary idiom.

The visitor could hardly fail to discern some of the major trends which emerged during the exhibition. Each section had something new to offer and many developments were of the greatest importance. One such was the shock-cure technique shown by the National Research Development Corporation on the stand of the Ministry of Supply. Notes on the process are published elsewhere in this issue and we shall watch its future development with the greatest interest. From first reports it would seem that in conjunction with phenolic/asbestos materials shock-cure offers important economic advantages in terms of time and power consumption particularly in fabricating large structures.

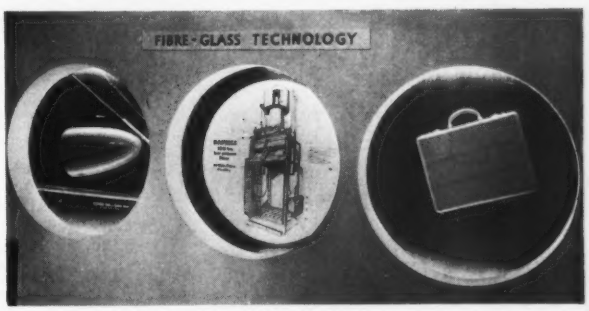
The use of glass fibre and fabric in conjunction with polyester resins was much in evidence. Readers may care to refer to the series of articles published in the June issue of this journal which dealt with various aspects of this development. Examples at the exhibition included a static water tank, two motorcar bodies, a motorcar hard top and a fishing rod. Also to be seen were special fabrications including accumulator cases, tubes, and ductings for aeronautical applications. It was quite apparent that the interest displayed in these exhibits by visitors would encourage further developments in the near future.

Machinery was one of the major features of the exhibition. Each stand seemed to be permanently surrounded by a crowd of onlookers. Mention must be made of the injection moulding machines incorporating pre-plasticizing units, capable of increasing the weight of material per shot by as much as three times. Other new items included take-off gear for extruding machines and automatic operating presses. Here the ingenuity of electrical apparatus has been applied to the best possible advantage, producing machines which are capable of automatic and frequently untended operation.

These are only a few of the many interesting developments brought to the fore during the exhibition. These and others are referred to in some detail in the review which follows. Space does not permit us to publish in this issue notes on all that we saw, and therefore another report will be published in August.

The order of presentation follows the sequence of the Exhibition Supplement published in the June issue of *Plastics*. Machinery is dealt with first, followed by mouldings and fabrications, and concluded by materials. The name of the company responsible for the exhibit described is given beneath each summary and the various items are presented in the alphabetical order of the companies within each group.

We were very pleased to see so many old friends at our stand and to make many new ones. It may be that the Coronation had something to do with the high spirits, not only of the exhibitors, but also of the visitors. This was reflected in a willingness to discuss mutual problems and an accord which set the tone of a most successful exhibition.



A close-up of the fibre-glass display on the stand of "Plastics."

MACHINERY AND ACCESSORIES SEEN AT THE EXHIBITION

IN this section we have selected some of the many interesting machines and accessories which were displayed at the Exhibition. Foremost amongst these were probably the pre-plasticizing units, designed to increase the output of injection moulding presses. Apart from this major development, there were many other improved and modified machines to be seen, and details and photographs of these will be found in the pages which follow.

Apart from the machinery manufacturers, many of whom may be regarded as forming part of the plastics industry, there are many other companies who support the industry in various ways, frequently by supplying specialized services. A number of such firms were represented at the Exhibition and include the British Ermeto Corporation, Beacon Works, Maidenhead, Berks, manufacturers of ancillary equipment for the industry. A speciality is a full range of pipe couplings, used widely on hydraulic presses and other hydraulically-operated machines, and high pressure valves.

Also showing was the Central Tool and Equipment Co., Ltd., Hemel Hempstead, Herts, manufacturers of routers. The majority of the thermoplastics can be cut with normal high-speed steel cutters, but certain of the more abrasive grades require special tungsten carbide tipped cutters, also supplied by the company.

Collinsons Precision Screw Co., Ltd., Forest Road, London, E.17, showed a variety of turned repetition parts and are well known as suppliers of screws to the plastics industry.

The Granbull Tool Co., 39 High Street, Kingston-on-Thames, specialize in the manufacture of moulds. Information was available on the stand as to the service provided by this company, which includes collaboration with the customer, if required, in the actual design of the tool required.

Manesty Machines, Ltd., Speke, Liverpool, 19, exhibited their well-known range of tableting machines, pre-forming machines, granulators, and steam stills.

A special feature on the stand of Simmonds Aerocessories, Ltd., Treforest, Glam, was the large range of Spire speed nuts, fixes, and clips. The products of the company are widely used in the industry since they greatly simplify design and production of many moulded articles.

Hand-operated bench injection-moulding machine

Designed for both laboratory and commercial use, the Asmidar machine has a maximum capacity of $\frac{3}{8}$ oz. A nozzle pressure is developed of 5,700 p.s.i., and production rates of up to 100 injections per hour are attainable.

Heating control is by rheostat and a special bi-metallic thermometer. The temperature control range is between 0-350° C. and the standard voltage is 220/250 v. A.C. The total weight of the machine is approximately 24 lb.

A hopper provides semi-automatic control of feed of powder to the cylinder. This, together with a rapid vice closure, ensures speedy operation and many industrial applications have already been found. These include experimental moulding, colour proving and pilot production. Medical and dental applications include bone replacements and dental surgery.

(Asmidar Plastic Moulding Machines Ltd., 5 Rampayne Street, London, S.W.1.)

Hydraulic down-stroking press

One of the features on the Bradley and Turton stand was an example of the range of self-contained hydraulic presses, built in sizes from 175 tons to 1,000 tons capacity. As a typical example may be mentioned the 360-ton press having a working pressure of 2,240 p.s.i. The main ram diameter is 22 in., stroke 24 in. Daylight is 36 in. and the press is powered by a 7½ h.p. motor.

Having an approximate net weight of 2,000 cwt., the press offers an independent unit requiring only to be coupled to the mains before being ready for operation. All presses throughout the range are fitted with independently controlled ejector gear.

(Bradley and Turton, Ltd., Caldwell Works, Kidderminster.)

Automatic injection-moulding machine

The type "HY" injection-moulding machine has undergone continual development since it was first introduced in 1947, the latest machine being the fully automatic design which was shown for the first time at the British Plastics Exhibition, where it was demonstrated operating at a speed of six shots per minute.

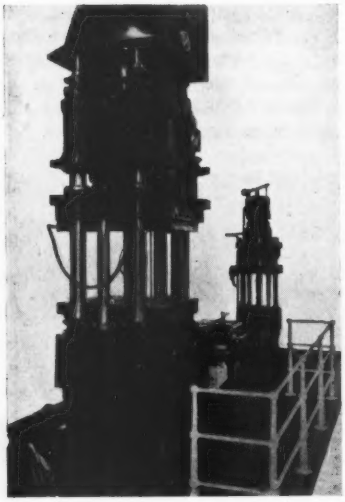
It was developed in order to satisfy the present-day requirements for a small machine which is capable of operating without any attention, apart from providing the supply of moulding powder.

The machine has a capacity of 1½ oz. of acetate per shot and special heater cylinders are available for use with nylon and p.v.c. The standard cylinder is, of course, useful for all the normal types of thermoplastic material commonly used for injection moulding.

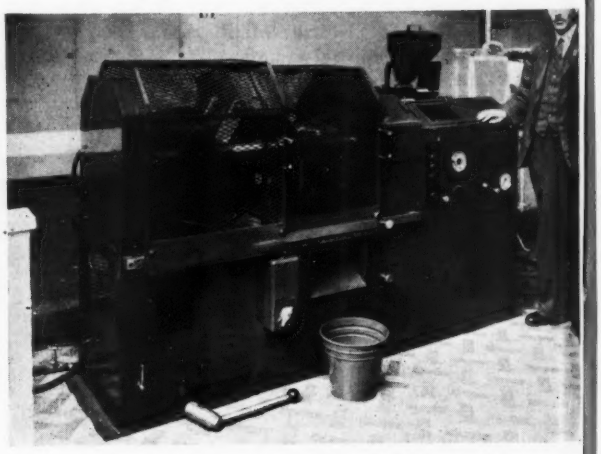
The machine is entirely self-contained, and has a vane-type pump; its motor is located, together with all the hydraulic piping and valves, in the base of the machine. The base, which is of welded-steel construction, functions also as an oil tank.

The main external difference between the fully automatic "HY" and the semi-automatic machine from which it was developed is the hydraulically operated rack and pinion, which replaces the capstan previously fitted for closing the dies. In addition, guards are now fitted over the links and dieplates. A hydraulic interlock is provided, so that whilst the guards are open the dies cannot be closed.

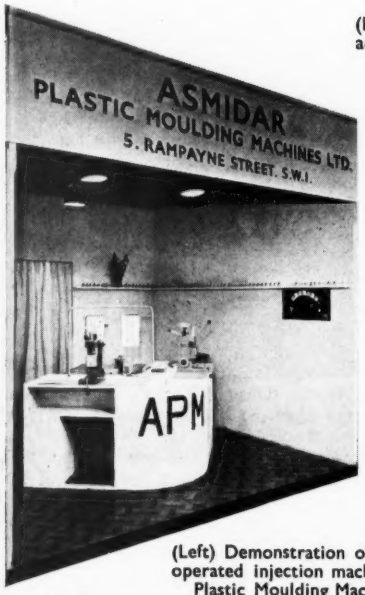
(*Continued on page 232*)



(Left) An example of the range of self-contained hydraulic presses manufactured by Bradley and Turton Ltd.

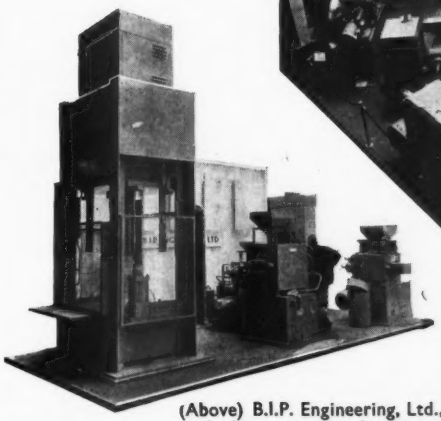


(Right) View of Herbert 1½ oz. injection moulding machine, manufactured by T. H. and J. Daniels, Ltd.

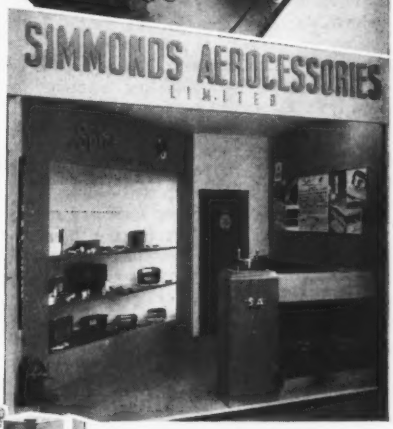


(Left) Demonstration of small hand-operated injection machine, Asmidar Plastic Moulding Machines. Ltd.

(Right) Part of the Projectile and Engineering Co., Ltd. stand.



(Above) B.I.P. Engineering, Ltd., with low pressure laminating press and pelleting machines.

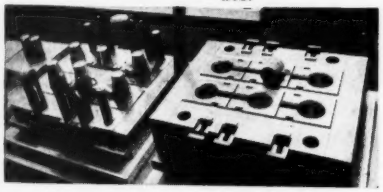


(Above) Fixing devices, Simmonds Aerocessories, Ltd.

(Above) Vacuum equipment, W. Edwards and Co. (London), Ltd.

(Above) Injection moulding machines, and granulating machine, Hupfield Brothers, Ltd.

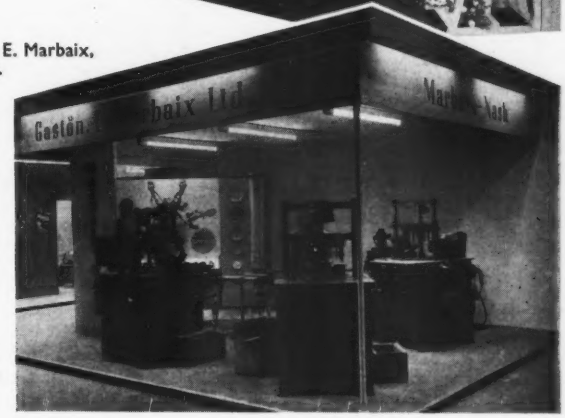
(Right) Moulding tools, Granbull Tool Co., Ltd.



(Left) Six impression tool for cup mouldings, B.I.P. Tools, Ltd.

(Below) Moulding tools, Universal Tools, Ltd.

(Right) Gaston E. Marbaix, Ltd.



MACHINERY AND ACCESSORIES—*Continued from page 230.*

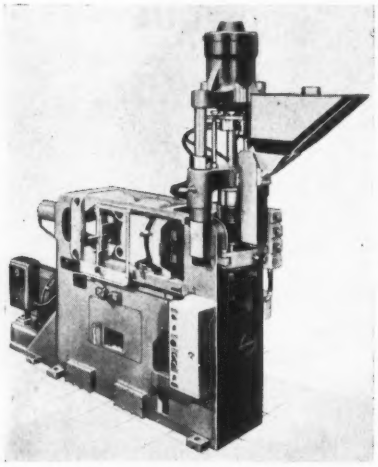
Apart from the alterations necessary to provide fully automatic operation, the specification of the machine differs very slightly from the semi-automatic model and the mould closing load remains at 30 tons. The maximum injection pressure on the material is approximately 7 tons per sq. in. A pressure-reducing valve is fitted, so that the injection pressure may be varied without affecting the locking force. The machine is manufactured by T. H. and J. Daniels for Alfred Herbert Ltd., Coventry.

(T. H. and J. Daniels Ltd., Lightpill Iron Works, Stroud, Gloucester.)

New Lester injection moulding machine

The new British-built Lester 4-oz. machine which was first seen at this year's British Industries Fair was seen in operation at Olympia. The machine has a number of interesting features including a solid steel box type frame construction, a double toggle locking mechanism and a large central die height adjusting screw. These features make it possible for the full locking pressure of 250,000 lb. to be concentrated over the total moulding area and allows unobstructed use of the whole platen face for die mounting. The vertical injection unit has internal and external heated cylinder with three separate pyrometer controlled heating zones, making for good plasticizing action, easy accessibility for spreader removal to facilitate change of material or colour. The nozzle-to-mould adjustment is made by a single screw and is unaffected by cylinder expansion. The machine is manufactured in Britain under licence from the Lester Engineering Company, Cleveland, U.S.A.

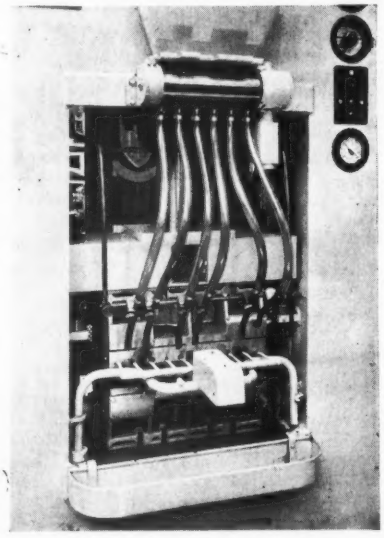
(Dowding and Doll, Ltd., London, S.W.1.)



4-oz. Lester injection moulding machine.

The "Lancastrian" 50-ton automatic moulding press.

A new model known as the "Lancastrian" model 2, 50-ton moulding press, has recently been introduced as an automatic press incorporating several new features. The new "Lancastrian" is, in every sense, completely automatic from the powder measurement and feeding to the final ejection and checking of the finished mouldings and the reinstitution of the moulding cycle. The total time cycle is 15 seconds plus the curing time, which, naturally, varies according to the type of moulding and the powder used. The tool area is extremely generous, the dimensions being 24 in. from left to right and 10 in. from front to back, with a daylight and stroke of 28 in. and 10 in. respectively. The powder feed gives a maximum of six cubic inches of loose powder in each of six cavities, but two or more feeds can be linked together to fill a smaller number of larger cavities. The press contains many interesting features, from the unit frame, fabricated and stress relieved, to the 2-ton per square inch hydraulic system and the patented cam controller.



Close-up of powder feed of the 50-ton automatic "Lancastrian" press.

The press may be stopped by the "stop" button at any part of its cycle; if the "start" button is then depressed the cycle will continue from the point at which it was interrupted. If, however, it is desired to recommence the cycle from the beginning the "re-set" button is depressed, which re-sets the cam controller without operating any valves; if the main ram is down it is returned by its individual push-button, the powder feed and ejector rams resetting themselves automatically. The "start" button can then be pressed and automatic moulding will recommence. Hydraulic top and bottom ejectors are provided, although it is unnecessary to use top ejector unless the mouldings have a tendency to stick on the punch. It should be noted that the ejector pins are automatically returned before powder is fed into the mould.

The standard press is supplied with automatic temperature control to be used with electrical elements built into the tools, but platens fitted with electrical induction coils for heating can be supplied as an extra, if required. The height of the press is 7 ft. 6 in. and it occupies a floor space of 4 ft. 3 in. width by 2 ft. 6 in. in depth.

(Foster, Yates and Thom, Ltd., Blackburn, Lancs.)

Automatic flash lathes

Much attention has been recently focused on techniques for automatically de-flashing moulded units. The Marbaix-Nash lathes have been designed to ensure positive and uniform removal of flash, confining the operation to a minimum surface line and thus maintaining the appearance of a moulded piece.

The variable feed and spindle speed feature allows an independent selection of the proper feed and spindle speed, depending upon the amount of flash removal required and the proper surface speed in relation to diameter of moulding. When using all 10 spindles, the machine will deal with diameters up to 4½ in., and up to 6 in. when using alternate spindles. The bottom spindles are power driven, the top spindles running free and having a slight float for piece location.

Production capacity depends upon the machine required, up to a maximum of 70 pieces per minute.

A number of standard tools can be supplied as accessories to the machines. These include abrasive and buffing belt units, file flashing units, grooving cutters and grinding-wheel assemblies.

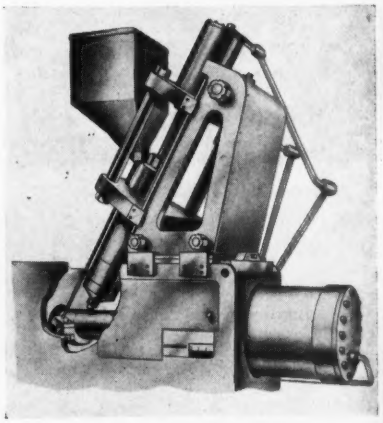
(Gaston E. Marbaix Ltd., Devonshire House, Vicarage Crescent, London, S.W.11.)

Improved injection moulding machines

A number of Peco injection moulding machines with improved capacity and new design features were shown. As was reported in *Plastics*, February 1953, increased plasticizing capacity with larger heating chambers is now available on the 4/5 ounce, 8/10 ounce, and 16/24 ounce machines. A pre-plasticizing unit has been fitted to the 8/10 ounce machine, giving it a maximum capacity of 16 ounces per shot.

Fully or semi-automatic machines of 1- and 2-ounce capacity are also produced.

(Projectile and Engineering Co., Ltd., Battersea, S.W.8.)

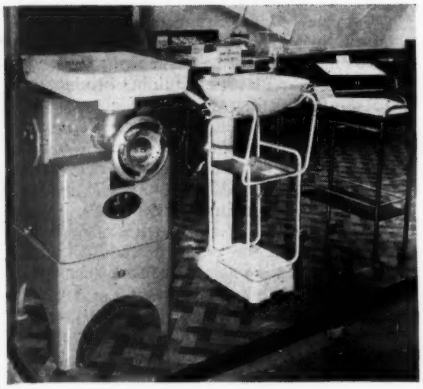


Preplasticizing unit for Peco 8/10 oz. machine.

Mould temperature control unit

In view of the recommendation for more accurate mould temperature control by the Productivity Team on plastics moulding, considerable interest has been aroused in the

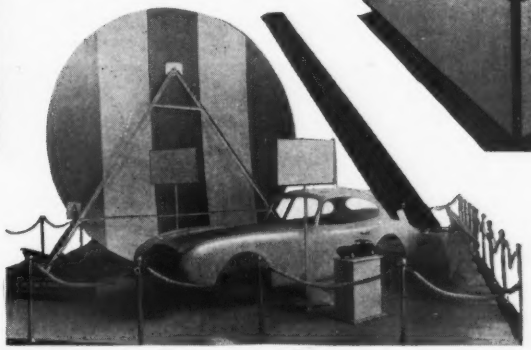
(*Continued on page 234*)



(Above) Fabricated Perspex components for food process machine, babies' scales and hairdressing equipment. William J. Cox, Ltd.

(Right) Heat-sealing equipment by Rediweld, Ltd.

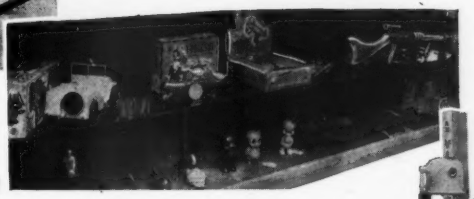
(Below) The non-commercial exhibit of large reinforced plastics mouldings arranged by *British Plastics* included a 14 ft. diameter radar scanner, a 30 ft. glider wing, and a complete one-piece car body.



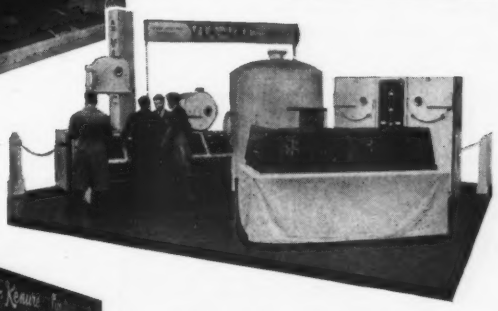
(Below) Melwood Thermoplastics, Ltd.

MOULDERS AND FABRICATORS, MATERIALS AND MACHINERY MANUFACTURERS' STANDS.

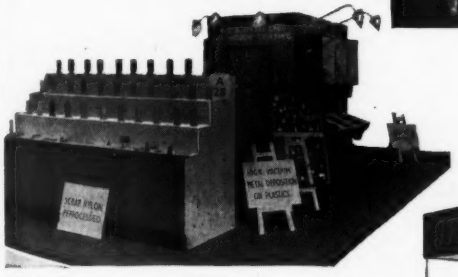
(Above) Monsanto Chemicals, Ltd.



(Above) Some Tudor Rose toys manufactured by Rosedale Associated Manufacturers, Ltd.



(Above) High Vacuum equipment, Vacuum Industrial Applications, Ltd.



(Above) The Dohm Group of companies showed reprocessed materials and vacuum metal deposition on plastics.

(Above) J. F. Kenure, Ltd.

(Left) I.C.I. Plastics Division.

(Right) Barrett and Elers, Ltd.

MACHINERY AND ACCESSORIES—*Continued from page 232.*

mould temperature control unit shown at the Exhibition for the first time.

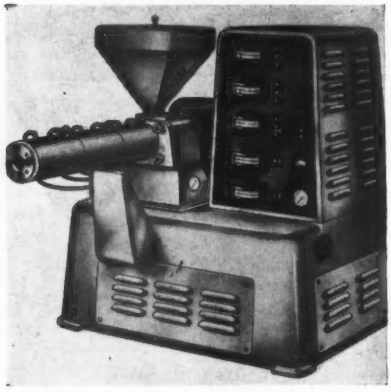
The unit makes use of water as a heat transfer medium and is capable of operating to a temperature of 220°F. without loss by evaporation. This is achieved by the use of a closed pressurized system—maximum pressure 25 p.s.i. The unit is designed to control one half of a mould only in accordance with the considered opinion of moulders that it is preferable to have two single units for use as a pair when necessary, or for use singly when control of one half only is required. The unit is designed to cool as well as to heat the mould, flow of water being diverted through either cooler or heater as required. This is performed by a motorized valve which is actuated by thermostatic setting.

(Projectile and Engineering Co., Ltd.)

New 2½-in. Extruder

A completely new design of plastics extrusion machine was shown for the first time at the Exhibition. The machine incorporates several novel features which should make it of particular interest where a number of different materials are to be processed in the same machine. The most interesting of these features is the provision of six different screws, i.e. three different screw designs and two different screw lengths. The barrel is constructed in three sections, the third of these being removable to accommodate the shorter type of screw. Another useful feature, particularly when extruding acrylic materials or rigid p.v.c., is a controllable cooling system at each zone of the cylinder to take off excess heat generated by internal friction in the material.

The die head has been designed so that two methods of die attachment are available



New Peco 2½-in. extruder.

for normal working. Attachment is by split clamp which by annular wedge action will hold the die rigidly in place; for small dies, particularly for polyamides, the clamp may be dispensed with and the die bolted directly to the extruder flange, thus avoiding heat losses at the die head.

The temperature control system is housed in a separate cabinet with indicating controls at eye level, each heating zone being provided with its own instrument so that no switching from one pyrometer head to another is required. The output capacity is from 70 to 100 lb. per hour.

A 4½-in. extruder, designed on the same principle, is now under construction.

(Projectile and Engineering Co., Ltd., Battersea, London, S.W.8.)

Pneumatically Operated Press Welder

The Radyne model P.W.22 radio frequency welding machine for thermoplastic sheet is a pneumatically operated unit with an output of 2 kW. at approximately 36 Mc/s. The welder table, in which the lower electrode is fitted, and the press head are constructed from heavy machined castings providing the great rigidity essential for correct alignment of electrodes. Several plate-type lower electrodes can be fitted to a maximum width of 24 in. or a depth of 14 in.; available sizes include 14 in. by 20 in. and 12 in. by 24 in. Extension brackets can be fitted to the table to provide additional space.

Radyne P.W. 22 press welder.

The welder has a synchronized process timer, incorporating an adjustable delay arrangement which permits the power to be switched on in three steps eliminating the danger of switching-on surges. This is particularly useful when employing tear-seal electrodes on thin grades of material.

Besides the process timer, controls include a single knob adjustment for power output, hand-operated air switch for the pneumatic mechanism, and start and stop buttons for the welding power supply.

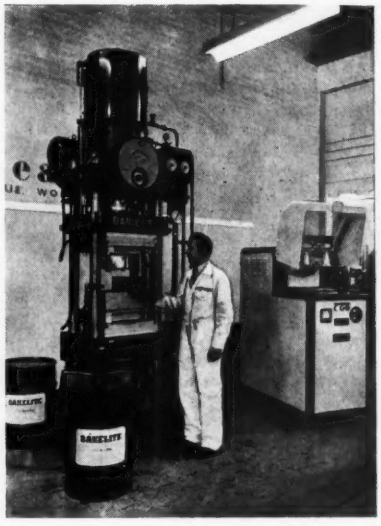
A 3-in.-diameter double-acting pneumatic pump is employed, pressure of the electrode on the work being controlled by an adjustable spring which can be set between 250 lb. and 450 lb.

A limiting stop mechanism can be fitted where a limited electrode sink is necessary.

(Radio Heaters, Ltd.)

New R.F. pre-heaters

Two new Radyne models have been produced in time for the Exhibition with particular reference to the recent recommendations of the Plastics Moulding Productivity Team concerning higher frequency and higher power R.F. pre-heaters. The new models are in two sizes. A small unit is available with two alternative outputs at 1¾ kW. (model H22) and 3½ kW. (model H50). The large unit, model H150, has an output of 15 kW. All these units are designed so that they can be used for normal speed pre-heating as well as for super speed pre-heating with special fast-curing moulding materials. In order that they may pre-heat at the faster rate without flashover the heaters operate at a frequency approaching 40 Mc/s. and have almost complete suppression of the switching-on surge and a very low ripple on their H.T. supplies. All three units have rapid automatic lead opening. A demonstration at the Exhibition illustrated the saving made possible by fast pre-heating. A radio cabinet with sections up to ½-in. thick was moulded in 1½ mins. The equivalent cure time with normal R.F. pre-heating and ordinary material is 3 min., with infra-red pre-heating 5 min. and 7-8 min. without pre-heating. In the demonstration pre-forms were heated to between 140° C. and 150° C. in 25 sec. With this technique pre-heating times of 20-60 sec. and R.F. power between 1½ kW. per 1 lb. of material are required.



Demonstration of super-speed pre-heating with Radyne model H150, 15-kW. heater and Daniels press operating at 160° C. and 50 tons pressure. Radio cabinets were moulded in 1½ min. cycles from Bakelite X17355 pre-heating grade phenolic moulding material.

(Radio Heaters, Ltd., Wokingham, Berkshire.)

New Welding Machine

This company is introducing a completely new range of plastic welding machines, including the J.P.10, a large press welder capable of dealing with very long straight welds in a single operation. Also included is the J.P.9 "Tong" welder, where the elec-

trodes are portable and connected to the generator by cable, and the J.P.7 a larger version of the popular model J.P.1, giving a considerably increased weld area.

Outstanding is the J.P.10 press welder, which sets a new standard of mechanical simplicity and construction in equipment of this type. It is powered by a separate 2-kW R.F. generator type R.H.36 operating at a high frequency. This combination enables over 8 sq. in. of weld area to be achieved on normal materials and, more important, a single straight line weld of over 4 ft. in length is possible and contours 6 ft. or longer can be readily tackled. The press can also be supplied with a sliding table for mass production work. This machine will enable many problems in the welding field to be solved, particularly in the manufacture of large articles such as inflatable mattresses, beach toys, long seams in plastic upholstery and complete seams in waterproof clothing.

(Redifon, Ltd.,
Broomhill Road, London, S.W.18.)

Colorimetric testing apparatus

In many branches of the plastics industry colour control is essential. The Lovibond colour scale makes possible the visual measurement of colour. The scale is permanent, internally uniform and reproducible and thus fulfils all of the requirements of an international scale.

(The Tintometer, Ltd., Salisbury.)

Industrial scrapers

Having a wide variety of profiles, Skarsten scrapers are employed for many applications in the plastics industry. Amongst these uses may be mentioned dressing down wood for laminating purposes and in the veneer field.

(Skarsten Manufacturing Co., Ltd., 21 Hyde Way, Welwyn Garden City, Herts.)

High-vacuum metal-coating plant

New designs of efficient plant for metal coating by vacuum evaporation was shown by Vacuum Industrial Applications, Ltd.

Their single-chamber plant has a 2-ft. internal diameter tank and is obtainable, alternatively, with the tank in a vertical position (the type E.V.24) or a horizontal (the type E.H.24). The tank is evacuated to a pressure of 0.1 micron (1/10,000 of a mm mercury) within three and a half minutes with an empty chamber and to 0.05 micron within ten minutes. In the single-chamber plant, all valves are operated by compressed air, as also is the raising and lowering of the chamber in the vertical model. All controls are centralized on the front panel of the plant. A 3,000-volt D.C. discharge is available for ionic cleaning and the plant can also be used as a sputtering plant. The H.T. transformer can be used through the Variac or directly from the mains so that H.T. discharge can be applied during evaporation. The low-voltage supply for evaporation is controlled by a time switch. The tank is made from a non-ferrous alloy which enables the application of external magnetic fields for the movement of internal parts and jigs, without feed-throughs through the tank walls or baseplate.

The twin-chamber plant, the type E.2.H.24 is designed for mass production. Its two tanks, each 2-ft. internal diameter, have their own 10-in. diffusion pumps and both are backed by a common 100 c.f.m. Kinney pump. These tanks give a vacuum of 0.1 micron in one and three quarter minutes.

The control of this twin unit is completely automatic though hand control is available should this ever be required. In the automatic control, indicator lights show the progress of the cycle and the fallibility of an operative is eliminated. The two tanks in this unit can be operated alternately or simultaneously at choice.

(Vacuum Industrial Applications, Ltd., Wishaw, Lanark.)

Fully Automatic Injection Moulding Machines

Fully automatic machines are now available with 1-ounce, 2-ounce and 4-ounce capacity, from R. H. Windsor, Ltd. The latest of these machines (first shown and described at the British Industries Fair) has 1-ounce capacity, but can be increased up to 2-ounces at 13,000 p.s.i. with additional liner and plunger.

Extrusion Take-off Equipment for Rigid P.V.C.

Principally used in combination with one of the Windsor multi-screw extrusion machines, a complete take-off equipment has been produced specifically to meet the requirements of producers of rigid unplasticized p.v.c. tubes.

The unit consists of a water cooling bath in four separate compartments, each with a rubber entry seal to suit the size of pipe to be extruded. There are a number of water cooling coils through which the pipe also passes, allowing cooling by spray via the coils as an alternative method to complete submersion. A positive pulling device consists of six sets of traction wheels, with medium soft p.v.c. serrated treads, adjustable to suit the size of pipe. Each wheel is positively driven by a worm from a common worm shaft. The rollers are driven by an infinitely variable speed unit suitable for making tubes from 0-4 in. diameter.

As a cut-off device, an 18-in. diameter circular saw, having a periferal speed of 6,250 ft. per minute is provided. When it is desired to cut off a length of tube, a vice mounted on the unit clamps the pipe causing the entire cut-off mechanism to travel at the same speed as the extrusion, while the cut is being made.

(R. H. Windsor, Ltd.)

Single-stage, multi-screw pre-plasticizer

A new pre-plasticizing injection-moulding machine was introduced by R. H. Windsor, Ltd., manufacturers of injection-moulding and extrusion machines for the plastics industry. It is known as the S.H.8/10 single-stage multi-screw pre-plasticizer unit. The new machine means that a single-stage and " in-line " system of pre-plasticizing is available. Until now pre-plasticizing units have functioned in two movements and have contained two distinct units, compared with the Windsor machine's one unit.

The consequent advantages of the new Windsor development are complete cleanliness without a trace of bleed-back; easier maintenance and cleaning of those parts in contact with the moulding material; easy colour or material change and a low-power consumption coupled with completely automatic operation. By pre-plasticizing the raw material on the same machine, articles three times as large, costing less and of better quality, can be produced. Thus the S.H.8/10 oz. machine can produce articles weighing up to 32 oz.

The plasticizing capacity—formerly about 60 lb. an hour—has been raised to 140 lb. an hour. The pre-plasticizer prepares a fully plasticized and homogenous material to the injection barrel. The complete cycle of operation commences with the material cylinder which contains a plunger, incorporating two specially designed screws, housed in a heat controlled barrel. An hydraulic motor transmits power, via a gearbox, to the screws; the whole moves freely within its stool and is connected to an hydraulic cylinder. Once injection has taken place the material is once more fed into the rear of the screws. They then rotate pressing the material forward, heating and plasticizing it as they do so. At the end of the screw drive it is fully plasticized and is delivered to the front of the barrel under high pressure.

The pressure exerted at the front portion of the barrel forces back the screws, gear drive and hydraulic piston against a predetermined pressure; the return movement can be arrested at any point of the stroke. As the movement is relevant to the weight of shot required it can, if necessary, be actuated to serve the same conditions as the " weigh-in " methods.

This stage of the complete moulding operation ends within the cooling period. The machine is closed and the plasticized material shot into the mould by the hydraulic cylinder—the screws and drive assembly moving forward with the action. During the injection phase the screws are stationary; once injection and moulding has occurred the complete cycle starts once again.

(R. H. Windsor, Ltd.,
Leatherhead Road,
Chessington, Surrey.)

Windsor S.H.8/10 pre-plasticizer unit.

MOULDINGS AND FABRICATIONS SEEN AT THE EXHIBITION

IT would be invidious, in a review of this kind, to select any one of the stands in this group for particular mention. It is sufficient to say that the products displayed were of a very high order, and indicated that moulders and fabricators were taking the fullest advantage of the latest developments in both machine design and raw material production.

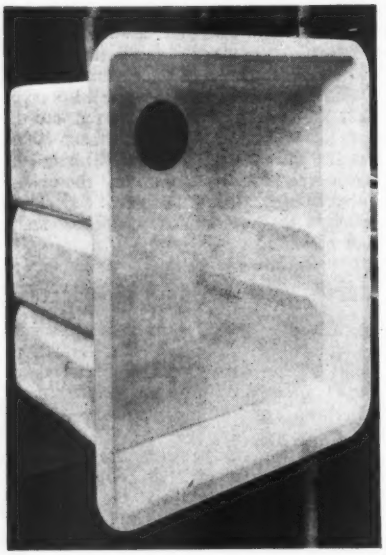
The general stand of large fabrications stressed the reinforced plastics technique. The display comprised a static water tank, manufactured by Microcell, Ltd., from glass fibre bonded with a polyester resin. Two mouldings by F. G. Miles, Ltd., were shown, a plastics glider wing (reported in the June issue of *Plastics*) and the radar aerial scanner, reported in the same issue, both fabricated from asbestos fibre bonded with a phenolic resin.

The fourth exhibit was a motorcar body constructed privately. This comprised a glass fibre reinforced polyester material, moulded over plaster-of-paris, the latter being broken away after cure.

Some of the interesting articles that were to be seen are reported in detail in the pages which follow and are amplified with photographs.

One-piece refrigerator interior

It should be emphasized that although this is in the development stage as far as the refrigerator manufacturers are concerned, it is already a practicable proposition from the fabrication point of view. The terms of reference were that it should be a 1½-cu.-ft. capacity interior of certain dimensions and that it should consist of shelf supports, water return rib, interior and breaker frame. It was decided after considerable discussion to try and make the article as a one-piece moulding in a single operation, and that in effect has been achieved. The material selected was ⅛-in.-thick rigid p.v.c. sheet and the main reason for selecting this in preference to the copolymer at that time was



Ashdown's refrigerator interior.

because of the availability of sheet size. In the early stages of sampling, considerable loss due to tearing of the material was experienced, but after a suitable technique was evolved some 30/40 interiors for field trials and other purposes were made with an extremely low loss figure considering the difficulties involved. As far as the design is concerned, the material is ⅛ in. to commence with and after moulding the bottom corners, which are obviously the thinnest point, are between .050/.060 in. thick. The internal dimensions of the interior are 15 in. x 15 in. x 12 in. deep and the radii in the corners is ¾ in. There is a 1° taper on the two sides and top of the moulding but no taper is permitted on the base as when fitted this would, of course, allow both articles and any condensation to run out towards the door of the refrigerator. The tool is, once again, all wood.

(Ashdowns Ltd., St. Helens, Lancashire.)

Rods

Ashdowns Ltd. have developed a technique by which glass fibre rods of various lengths and diameters can be produced from glass yarn and polyester resins. These rods find their application in the electrical industry and as fishing rods, etc.

(Ashdowns Ltd., St. Helens, Lancashire.)

Cash register keys

A technique developed by Barclay-Stuart (Plastics), Ltd., provides for multi-coloured cash register keys to be manufactured in one operation. The material employed for this application is cellulose aceto-butyrate.

(Barclay-Stuart (Plastics), Ltd., 25-27 Brunswick Street, Luton, Beds.)

Electrical mouldings

A casual visitor to the Exhibition might not have realized the importance of some of the mouldings produced for the electrical industry. Units having critical tolerances and rigid electrical properties are not necessarily glamorous but nevertheless they reflect one of the finest examples of the tool makers' and chemists' art. This is especially true when the mouldings concerned have delicate inserts, and much to interest the engineer was to be seen on the stand of Barrett and Elers, Ltd. Electrical mouldings of all kinds, in phenolic materials, were on display.

(Barrett and Elers, Ltd., Dace Road, London, E.3.)

Electrical relays

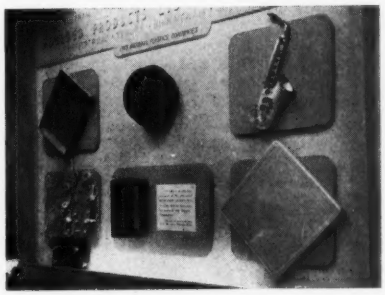
Stringent specifications, in terms of electrical insulation values and dimensions, governed the manufacture on a range of mouldings for electrical relays. Birkbys Ltd. met these demands by employing nylon to manufacture four bobbins, three armature windings in urea and three support mouldings in phenolic material. Apart from other considerations, exact dimensions were essential to ensure a high rate of assembly and interchangeability.

(Birkbys Ltd., Liversedge, Yorkshire.)

Tubing for industrial and medical use

Manufactured for Prodorite Ltd., British Moulded Plastics Ltd. displayed examples of tubing fabricated for applications in industry and hospitals. The complete process of manufacture, including design, tool making and assembly, is carried out by the company and welding is employed in the fabricating technique. The p.v.c. material used is specified because of flexibility, resistance to shock, because it is stainless, and because of its resistance to chemicals.

(British Moulded Plastics Ltd., Avenue Works, Walthamstow Avenue, London, E.4.)



Examples of various mouldings shown on the stand of British Moulded Plastics Ltd.

A Polystyrene Bird Cage

A new and unusual product of Ekco Plastics Division is a bird cage produced completely in polystyrene for "Sunnytoys" (Distributors), Ltd., of Blackpool. and marketed as the "Sunnycage." The body of the cage is moulded in two identical sections from one tool and chemically welded. It is produced in four colours, green, blue, pink and gold. The doors, swing, perches, tray, and cups with which the cage is fitted are made in the same material, resulting in a finished article which is strong and light. The cage and its components cannot warp or tarnish, and can easily be washed in soapy water. All parts can be readily dismantled for cleaning, and reassembled with the utmost ease. Since the polystyrene is completely resistant to attack by lice and mites these cages have a great appeal on grounds of hygiene as well as from their attractive appearance.

(E. K. Cole, Ltd., Southend-on-Sea, Essex.)

A New Roof Light

A new product manufactured by this company is a roof light, 3 ft. 10 in. in diameter, in Perspex. The advantages of this type of roof light include good ventilation, unbreakable surface, and it does not require the wire reinforcement called for when glass is used. It is being manufactured for the Essex County Council for use in schools, where, of course, there is great emphasis on the safety factor. These roof lights can be

(*Continued on page 238*

STANDS OF SOME MOULDERS AND FABRICATORS AT THE EXHIBITION

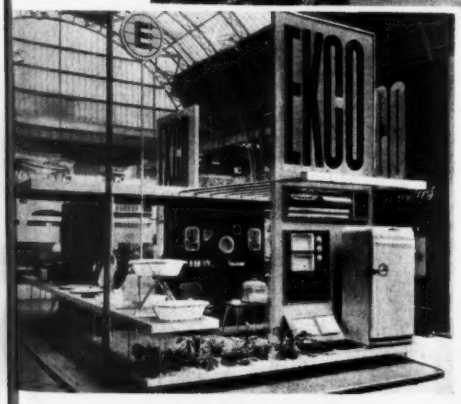
(Left) Insulation Equipments, Ltd.

(Above) Wilmot Breeden, Ltd.

(Left) Insulators, Ltd.

(Right) General Electric Co., Ltd., Witton Moulded Insulation Works.

(Above) Birkbys, Ltd.



(Above) E. K. Cole, Ltd., Plastics Division.

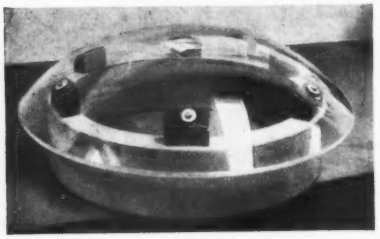
(Left) Microcell, Ltd.

(Above) Thermo-Plastics, Ltd.

(Right) E. R. Holloway, Ltd.

(Left) Telegraph Construction and Maintenance Co., Ltd.

MOULDINGS AND FABRICATIONS—*Continued from page 236*



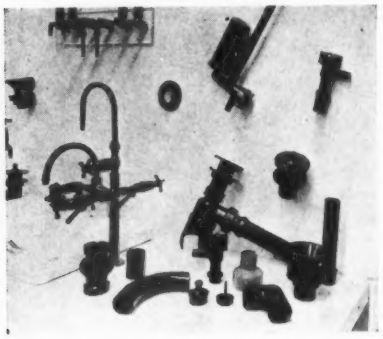
Model of acrylic rooflight.

manufactured in circular, square, or rectangular shapes. The washers bearing the screw heads are in p.v.c.

(G. Williaam J. Cox, Ltd., Tower House, Great North Road, London, N.2.)

Plumbing

Employing injection-moulding machines specially devised for the purpose, Folkard-Ferry Ltd. manufacture sink wastes, drip wastes, sink trays and other plumbing accessories. The material used is polythene and, apart from the extrusion of tubing which is done for the company, all other work is carried out by them. This includes welding with Rockwell hot-gas torches. A new waste trap is claimed to give a much longer



Examples of polythene in plumbing.

life under service conditions than its metal counterpart. This unit is designed for normal domestic use; the actual cap, of polythene, is encircled at the shoulder by a metal ring which is threaded. By ingenious design, the rim of the polythene cap is brought flush against the other part of the sink trap when the ring is screwed up, thus ensuring a water-tight seal.

(Folkard-Ferry Ltd., Archetype Works, Edgware, Middlesex.)

Torch bodies

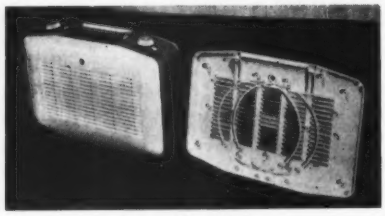
In the manufacture of attractively-coloured torch bodies, G.E.C., Ltd., employ the injection-moulding technique, using polystyrene as the moulding medium. This material has certain inherent advantages, in that it is light, and will withstand reasonable wear. The actual moulding calls for considerable ingenuity by virtue of the depth of the draw.

(General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.)

Pye radio cabinet

Using polystyrene powder manufactured by Monsanto Chemicals Ltd., Halex is producing on a 16-oz. Peco machine the back and front of a portable Pye radio cabinet. The moulding is of considerable complexity, measuring some 16 in. x 12 in. Provision for inserts is made, all designed to be of the self-tapping variety.

(Halex Ltd., Highams Park, London, E.4.)



Pye radio cabinet.

Projection television screen

Employing a transparent grade of Cobex, 15 thou. thick, a television projection screen was displayed. Embossed on one side is a Fresnel lens. The use of this material facilitates the production of a high-fidelity screen having optimum optical values under mass-production conditions. A Bipel press is employed in the production.

(Halex Ltd., Highams Park, London, E.4.)

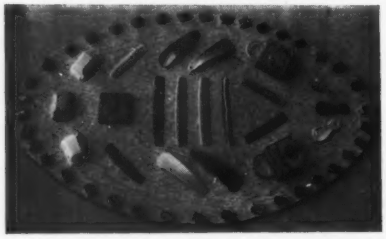
Combs

The nylon comb, virtually unbreakable, was one of the features of the stand of E. R. Holloway Ltd., who have long specialized in comb manufacture. Apart from their strength characteristics, nylon combs can be sterilized. The range of present manufacture comprises six styles and the company proposes to introduce in the near future a model suitable for the hairdressing trade.

(E. R. Holloway Ltd., Hyde Way, Welwyn Garden City, Herts.)

Radio Cabinet for Kolster-Brandes, Ltd.

Design can very easily make or mar a moulded article and the standard of design in the plastics industry has risen immeasurably in recent years. A particularly happy example is the radio cabinet, injection moulded in polystyrene for Kolster-Brandes, Ltd. This has been carried out by Injection Moulders, Ltd.; the design called for an



Examples of mouldings by Injection Moulders, Ltd.

intricate moulding, having an unconventional curved design, with a quantity of frets and louvres. In addition, the radio experts specified certain arrangements for the interior sections to ease assembly and to locate the various parts.

(Injection Moulders, Ltd., Westmoreland Road, London, N.W.9.)

Railway coach work

Climatic conditions are frequently arbiters in the use of plastics materials. Laminates have special advantages to offer under tropical conditions in that they are dimensionally stable, highly resistant to attack by fungi and wood-boring insects, and retain a high finish. Examples of the use of decorative laminates in railway coach construction were shown on the stand of Insulation Equipments Ltd. Fabrications by this company have been ordered by authorities in Ceylon, India, Kenya, Nigeria.

(Insulation Equipments Ltd., Salop Road, Oswestry, Shropshire.)

Adding Machine Cases

The more complex modern office equipment becomes, the greater the need for using plastics where possible. Portability is very desirable, and this can only be achieved when units are reasonably light in weight. An example of this was shown on the stand of Insulators, Ltd., a case for an adding machine. Compression moulded in a phenolic powder, the case is attractive to look at, durable, easy to clean, and light in weight.

(Insulators, Ltd., Angel Road, London, N.18.)

Golf club heads

The many golfers in the plastics industry will be interested in the putter head moulded in fast-curing phenolic material, weighted with some 10 oz. of metal. The head is moulded in a single-impression tool with the hole in place to carry the shaft. Whilst the Plastics Exhibition was actually in progress, samples were delivered to St. Andrews, where they were to be used in the Open Championships.

(Kent Mouldings, Footscray, Sidcup, Kent.)

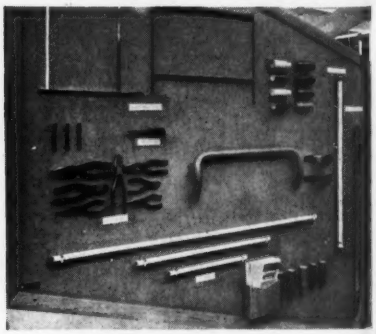
Measuring beaker

Constructed to contain 20 fluid oz. and graduated also in cubic cm., a beaker is moulded in polythene by J. F. Kenure Ltd. The beakers are moulded on an 8 oz. Reed-Prentice injection-moulding machine and the design incorporates a lip for pouring.

(J. F. Kenure Ltd., Faggs Road, Feltham, Middlesex.)

Vietum

The first announcement of this specially modified p.v.c. material was mentioned in the December, 1952, issue of *Plastics*. Having the ability to shrink when heated, sleevings are now employed for the produc-



Demonstrating the application of Vietum.

tion of plier handles and threads. In the latter case, not only are threads protected against damage during transit and storage,

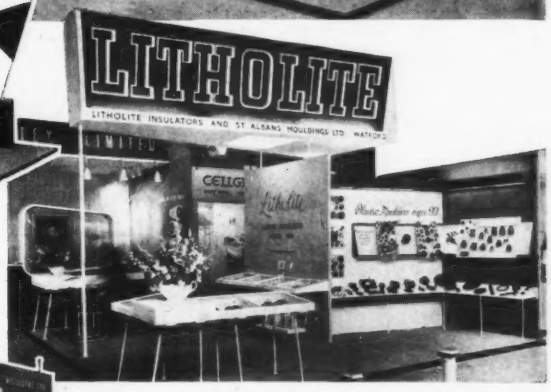
(*Continued on page 240*)

(Above) Punfield and Barstow (Mouldings) Ltd.

(Right) Lacrinoid Products Ltd.

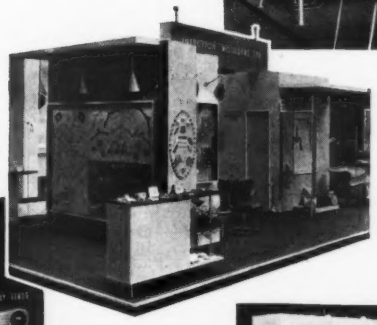
(Above) United Ebonite and Lorival, Ltd.

MOULDERS AND FABRICATORS AT THE EXHIBITION

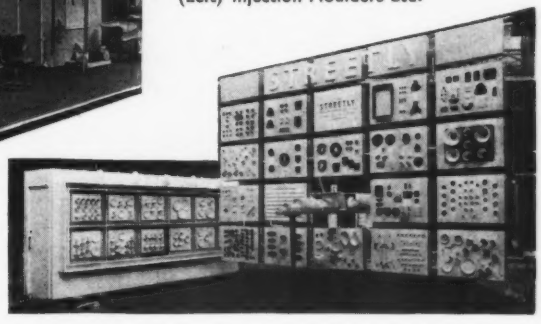


(Above) Litholite Insulators and St. Albans Mouldings, Ltd.

(Below) Splintex Ltd.

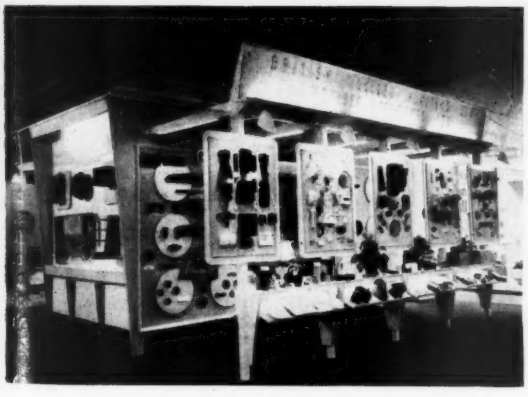


(Left) Injection Moulders Ltd.

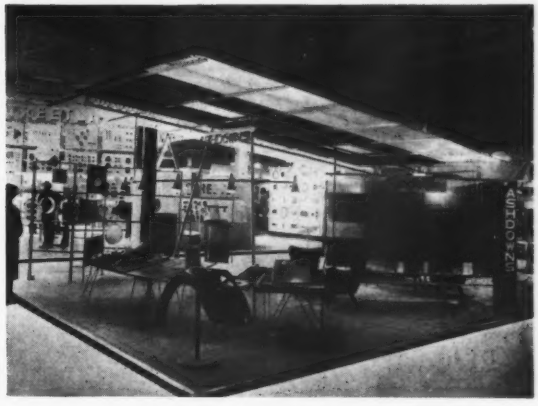


(Above) Streetly Manufacturing Co., Ltd.

(Below) British Moulded Plastics Ltd., and Moulded Products Ltd., combined stand.



(Below) Ashdowns Ltd., with corrugated glass fibre laminate roof for the stand.



MOULDINGS AND FABRICATIONS—*Continued from page 238*

but are also safe against attack by moisture. Future applications are considered to be considerable and already the material is being employed as a covering for golf club shafts, on frames for travelling wardrobes and on handles of various kinds.

(Lacrinoid Products Ltd., Gidea Park Works, Gidea Park, Essex.)

Thermos vacuum vessel

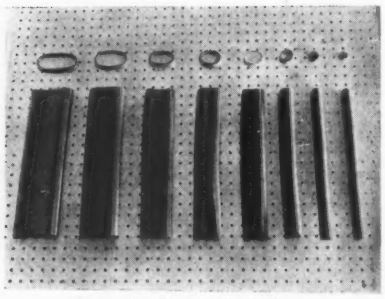
An elegant vacuum vessel for picnic and domestic use is moulded for Thermos Ltd., in white paper filled urea and cabinet grey walnut phenolic. The base and lid are single impression mouldings and the fittings which include feet, handles and knobs are moulded on multi-impression tools. Phenolic powder employed is supplied by British Resin Products Ltd., and urea paper filled powder by Bakelite Ltd.

(Litholite Insulators and St. Albans Mouldings Ltd., Sandown Road, Watford, Herts.)

Extrusions

The applications of extruded materials grow year by year, and the reader may care to refer to the May issue of "Plastics" for details of some of the latest developments. Die design has played a large part in stimulating interest in the potentialities of extrusion. On the stand of Melwood Thermoplastics, Ltd., were examples of tubes, rods and profiled sections, in cellulose plastics and p.v.c.

(Melwood Thermoplastics, Ltd., Willoughby Road, Harpenden, Herts.)



Examples of extruded tubes.

Static water tank

The largest exhibit of the "British Plastics" Exhibition was a water tank assembled from 4-ft.-square panels moulded from polyester resin-bonded fibre-glass material. A tank for 3,600 gallons was assembled from a number of these units. Resistance to corrosion from water and a number of chemical solutions together with light weight and ease of assembly are the principal advantages of these tanks over conventional metal ones. Light weight is a particularly important feature for temporary tanks which must be transported.

(Microcell, Ltd., 56 Kingsway, London, W.C.2.)

Pickling cabinet

Fabrication from p.v.c. is the speciality of Rediweld, Ltd., and an interesting example of this company's products was a pickling cabinet some 4 ft. high, 5 ft. wide, and 3 ft. deep. The closure at the front slides back into the body of the cabinet when open, and the interior has provision for the location of special trays and apparatus. The result of the product (fabricated by welding sheet material) is very strong and highly resistant to corrosive liquids.

(Rediweld, Ltd., 15 Crompton Way, Crawley, Surrey.)

Toys

Ingenious is the art of the toy maker, and a fascinating display was organized by Rosedale Associated Manufacturers, Ltd. Employing cellulose acetate, polystyrene, and p.v.c., examples were shown of many kinds of toys, ranging from dolls for the very young to the elaborate reproductions of fighting vehicles.

(Rosedale Associated Manufacturers, Ltd., 11 Upper Grosvenor Street, London, N.W.1.)

Acrylic materials

One of the features of the Splintex, Ltd., stand was a range of complex articles built up to the required thickness by skilful lamination. One such was an acrylic rod of four-inch diameter, built up from several layers of standard sheet thickness, in such a way as to give perfect transparency. Other exhibits demonstrated the versatility of acrylic materials in the production of display stands. This is a field in which the company specializes, and attractive examples were shown of screen printing and engraving units, taking especial advantage of the internal lighting properties of the material.

(Splintex, Ltd., Nightingale Road, London, W.7.)

Tableware

One of the most impressive displays was the collection of melamine tableware by the Streetly Manufacturing Co. Ltd. In a wide range of colours were many examples of cups, saucers, plates, beakers and bowls. The advantages claimed for melamine include resistance of breakage, hot water, soap and detergents, and light weight and hard finish. The mouldings are tasteless and odourless and exhibit a high level of industrial design.

Melamine tableware.

(Streetly Manufacturing Co. Ltd., Streetly, Sutton Coldfield, Birmingham.)

Display units

An eye-catching feature of the Thermo-Plastics Ltd. stand was the Enos fruit salts display unit. The main structure is moulded in one piece from clear acrylic sheet. The colours and lettering are applied to the rear surface and subsequently protected by a sealing compound. The unit is some 2 ft. in height and fitted to the front is an acrylic bowl containing water. Through this air is pumped to yield a most attractive display.

(Thermo-Plastics Ltd., Luton Road Works, Dunstable, Beds.)

Eno's display by Thermo-Plastics Ltd.

Accumulator covers

Designed for Percival Aircraft Ltd., Thermo-Plastics Ltd. have fabricated accumulator covers measuring some 2 ft. in length x 1 ft. width and depth. The job called for a material that was resistant to chemicals, was dimensionally stable, strong and light. Glass fabric bonded with a polyester resin has been employed and each case houses two accumulators.

(Thermo-Plastics Ltd., Luton Road Works, Dunstable, Beds.)

Fabrications in Ebonite

Ebonite for a very long time has been employed in the fabrication of battery cases but since the war great technical advances have enabled the modern battery case to be moulded in hard rubber. Several moulded containers showed the robust designs and high finishes obtainable by this method while other mouldings demonstrated the very wide use of this material—particularly for chemical and certain electrical applications where its characteristics are claimed to be superior to those of many newer synthetics.

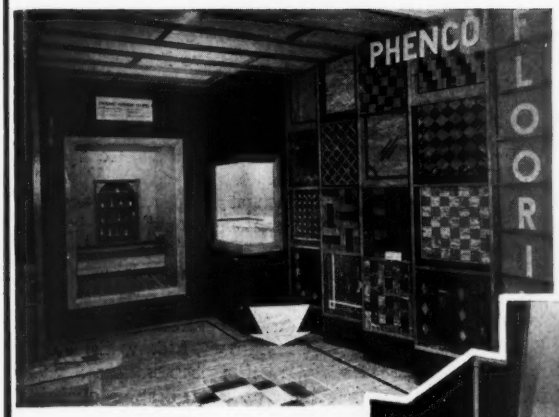
(United Ebonite and Lorival, Ltd., Little Lever, Nr. Bolton, Lancs.)

3-dimensional plastics

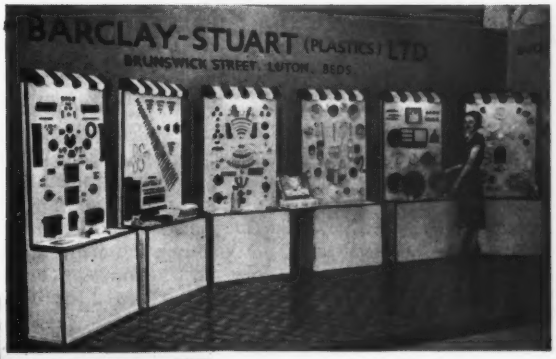
The design service offered by Wilmot Breeden, Ltd., was one of the main features of the stand at the Exhibition. Design is all important if successful results are to be obtained.

The manufacturers state that the technique compares competitively in price if runs of 5,000 or more are required. The process calls for injection moulding in clear acrylic material with a design carried out in relief on the under surface on which paint or metal is deposited. Metals such as aluminium are vaporized and deposited under a high vacuum.

(Wilmot Breeden, Ltd., Anington Road, Birmingham, 25.)



(Above) Phœnix Rubber Co., Ltd.

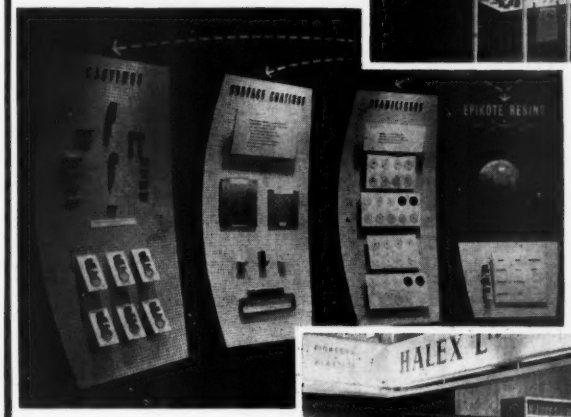


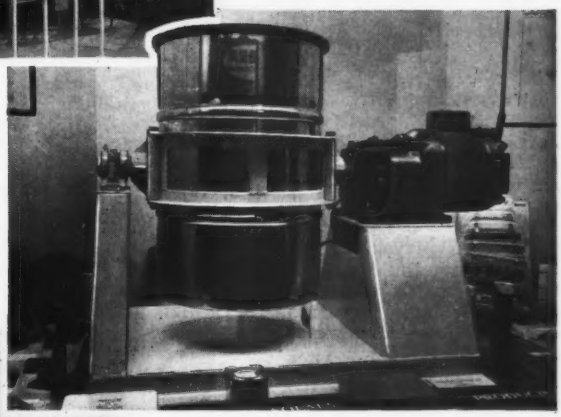
(Above) Barclay-Stuart (Plastics), Ltd.

(Left) Kent Mouldings.

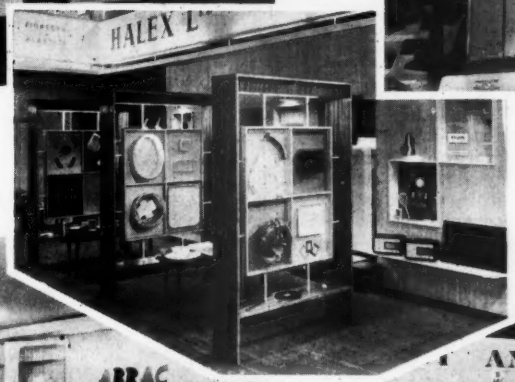
(Below) Epikote resin display, Shell Chemicals, Ltd.

MOULDERS & MATERIAL MANUFACTURERS AT THE EXHIBITION





(Above) Revolving drum mixer for dry colouring of polystyrene, shown by Williams (Hounslow), Ltd.



(Left) Bex household articles and trade mouldings, Halex, Ltd.

(Below) A. Boake Roberts and Co., Ltd.

(Below) East Anglia Plastics, Ltd.

MATERIAL DEVELOPMENTS AT THE EXHIBITION

THE raw material manufacturers' exhibits in the gallery at Olympia provided an interesting collection of stands. As it is never easy to provide a novel or eye-catching display with bottles of resins and chemicals or with plain sheet materials, most exhibitors concentrated on showing how their materials were used to make the finished products of the industry. In this section of the exhibition the manufacturers of glass-fibre bonding resins drew most attention. The four manufacturers of polyester resins (Bakelite, Ltd., British Industrial Plastics, Ltd., British Resin Products, Ltd., and Scott, Bader and Co., Ltd.) showed large structures such as car bodies, bus components, fish boxes and boats, whilst Shell Chemicals showed that their epoxide resins can also provide useful bonding agents for glass-fibre structures.

The glass-fibre material manufacturers showed a great variety of woven and matted reinforcing materials designed specially for low-pressure lamination. In the field of moulding materials a new fast-curing phenolic moulding powder was shown by Bakelite, Ltd., and this was demonstrated in another section of the exhibition in connection with high-power radio frequency pre-heating equipment. New thermoplastic moulding materials included polystyrene with improved impact strength and better heat-resisting properties. Styrene Products, Ltd., in conjunction with Erinoid, Ltd., now produce five specialized polystyrenes, whilst Monsanto Chemicals, Ltd., and British Resin Products, Ltd., also have improved impact grades.

Vinyl materials in many forms were to be seen throughout the exhibition, and British Geon, Ltd., as manufacturers of the basic materials, successfully showed the diverse applications of vinyl materials in rigid and flexible forms. Great attention was paid to rigid vinyl sheet materials, particularly for fabrication of chemical apparatus. Now available in clear transparent grades and suitable for fabricating and moulding by a variety of techniques are such materials as Cobex (BX Plastics, Ltd.), Vybak (Bakelite, Ltd.) and Darvic (I.C.I.).

New designs of embossed fabric-supported sheeting were shown by Arlington Plastics Development, Ltd., whilst Storey Bros. and Co., Ltd., demonstrated thin deep-embossed p.v.c. sheeting giving a very soft feel and excellent draping qualities. The use of p.v.c. film for packaging was emphasized by BX Plastics, Ltd., and Greenwich Leathercloth Co., Ltd.

Improvements in plasticizers and stabilizers included a new range of polyester plasticizers (Geigy Co., Ltd.) and a number of long chain ester type plasticizers. The epoxide resins are also recommended as stabilizing compounds for p.v.c. In the following review it has been possible to mention only a few of the items of interest in this section of the exhibition. It is hoped to deal with some of these developments in greater detail in future issues of *Plastics*.

Fabrications from Cobex

Many new applications for fabricated Cobex vinyl copolymer sheet were shown on the BX Plastics stand. Some of the most ingenious uses have been in chemical apparatus where the acid resisting properties are of great importance. Prodorite, Ltd., fabricate ducting, exhaust vents and similar components, British Filters, Ltd., are using the material to mould filter plate units. In the refrigeration field complete liners have been made and the ease of obtaining deep drawn mouldings in this material has been exploited. Transparent grades are used as side screens on sports cars where their clarity and non-inflammability brings great advantages over celluloid. For laboratory ware Rediweld, Ltd., have fabricated a number of test tube racks from Cobex.

Polystyrene Moulding Materials

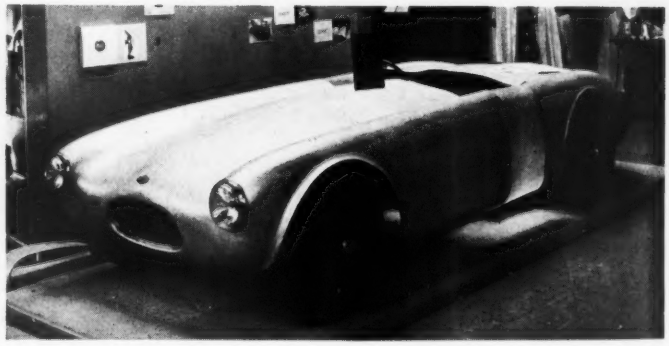
BX Plastics are now introducing Bextrene as the new trade mark for their polystyrene moulding materials. These are available in the normal range of colours.

(BX Plastics, Ltd., Chingford, London, E.4.)

Car Body

The exhibit arousing most interest on the Bakelite stand was undoubtedly the car body moulded by the North East Coast Yacht Building and Engineering Co., Ltd., from glass fibre mat bonded with Bakelite polyester resins. This body was shown by courtesy of the owners, D. Smallwood and T. O. Adkin. It is supplied by R.G.S. Automobile Components, Ltd., and is intended for the amateur car builder. The body is now in general production and freely available at an overall price of £90 ex works. There are two main pieces with two separate sections for doors. Together with the panels a pack containing glass mat and Bakelite resin is provided to enable the amateur to carry out his own adjustments and to mount the body on a tubular metal frame.

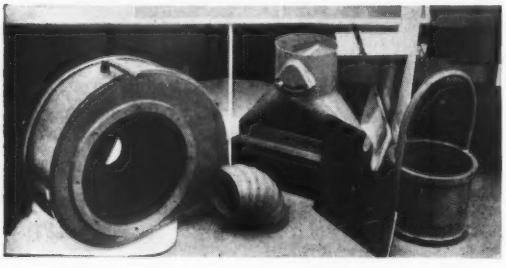
(Bakelite, Ltd., London, S.W.1.)



(Right) Car body on Bakelite, Ltd. stand.

P.V.C. Conveyor Belting

In view of the great interest shown recently in conveyor belting, particularly coal-mine convevors, the Geon stand showed a number of such belts impregnated and coated with materials based on Geon p.v.c. resins. The great advantage of this material over rubber is the elimination of fire hazard and their considerable abrasion resistance.



Cobex fabrications for chemical equipment.

P.V.C. for Clothing

On the Geon stand clothing ranging from protective garments for chemical workers, trawlermen, etc., to attractive rainwear fashions were demonstrated. Clothing is made up from calendered p.v.c. sheet as well as from impregnated textile materials which now almost universally replace traditional oil skins.

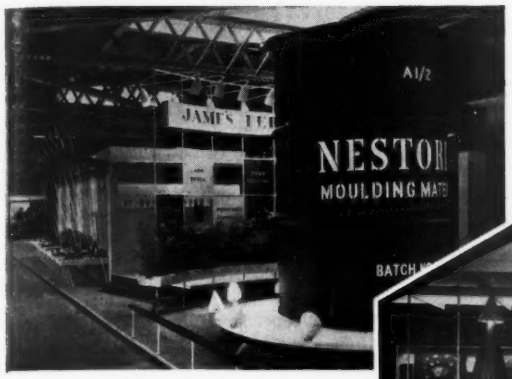
(British Geon, Ltd., St. James's Square, London, S.W.1)

Tests for Melamine Ware

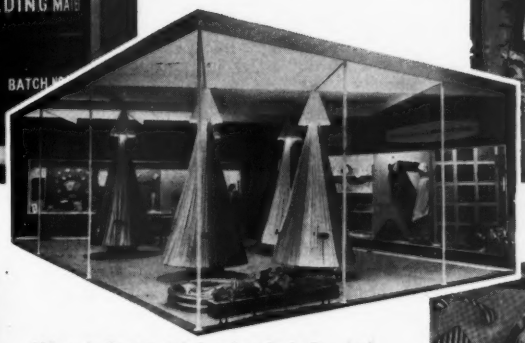
In collaboration with the large Oxford Street Branch of Littlewoods Stores, British Industrial Plastics, Ltd., as manufacturers of melamine formaldehyde moulding materials have carried out a test of various designs of moulded melamine cups, saucers, plates, etc., under the rigorous conditions of a cafeteria serving thousands of customers every day. It was found that far lower breakage rates occurred using plastics than when the corresponding ceramic equipment is used. The melamine ware retained its surface gloss, and even resisted marks from burning cigarettes. Valuable information was obtained during the test on conditions for washing the pieces and other methods of

(*Continued on page* 244)

MATERIALS EXHIBITORS



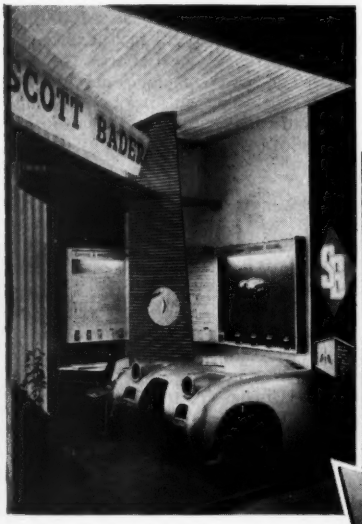
(Above) James Ferguson and Sons, Ltd.



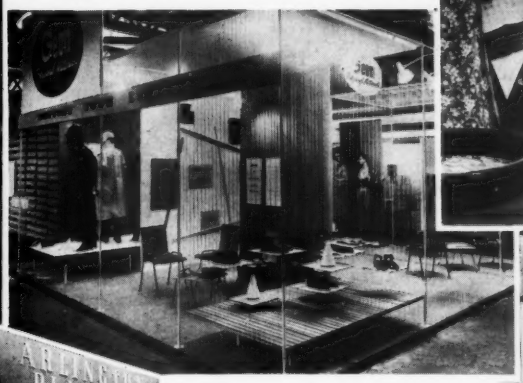
(Above) Greenwich Leathercloth Co., Ltd.

(Above) Glass Yarns and Deeside Fabrics, Ltd.

(Right) Storey Brothers and Co., Ltd.

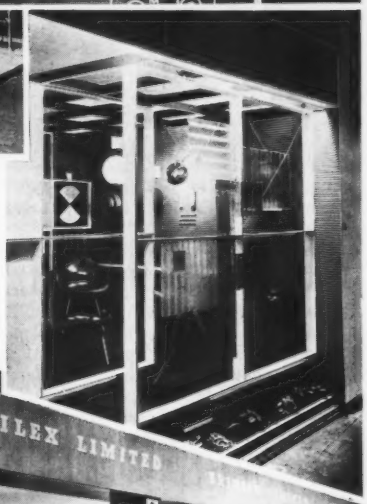


(Above) Scott, Bader and Co., Ltd.



(Above) British Geon, Ltd.

(Right) Fibreglass, Ltd.



(Right) Arlington Plastics Development, Ltd.

(Below) Combined stand of Erinoid, Ltd., Styrene Products, Ltd. and Utilex, Ltd.

(Below) Kitchenette showing use of melamine ware, on the stand of British Industrial Plastics, Ltd.

MATERIAL DEVELOPMENTS—*Continued from page 242.*

handling. On the British Industrial Plastics stand at Olympia a range of moulded melamine ware from many moulders was shown and a fully equipped kitchen showed how the pieces stand up to heat, washing, etc.

Polyester resins for glass reinforced structures

The British Industrial Plastics Group has recently agreed with Carbide and Carbon Chemicals Corpn. of the U.S.A., to manufacture polyester resins based on the successful Laminac resins produced in the U.S. Some fabrications from these resins were shown on the stand including two of the boats made by W. and J. Tod, Ltd., road signs by Norton Plastics, Ltd., and chairs by F. Lewis and Sons, Ltd.

(British Industrial Plastics, Ltd., Argyll Street, London, W.1.)

Polyester laminates at high temperature

Cellobond polyester resin 13,002/191 was shown at the Exhibition in the form of glass cloth laminate under flexural test at high temperature. It is found that this type is the most rigid both at room and elevated temperatures. Figures of mechanical and electrical properties for a test laminate made from this resin are available.

(British Resin Products, Ltd., 21 St. James's Square, London, W.1.)

Demonstration of polyester/glass-cloth laminating, British Resin Products, Ltd.

Polystyrene information

A new leaflet produced by Erinoid together with Styrene Products sets out the properties of the different grades of polystyrene supplied by these companies. Tables of mechanical, thermal, optical, electrical and chemical properties are given and further technical data includes a table for locating and curing different moulding faults. It is interesting to note that packets of colourants in units sufficient to colour 60 lb. of polystyrene can be supplied together with clear polystyrene, for dry colouring.

Chemical piping

Extruded and plasticized p.v.c. piping with a very high degree of surface finish in sizes up to 2½-in. diameter find uses mainly in the chemical industry for conveying corrosive liquids. It is possible to shape and bend the tubes, and flanges can be welded to them.

Water stop for concrete

A sealing strip extruded from p.v.c. by Expandite, Ltd., is embedded in concrete to provide a waterproof seal between adjacent blocks. The flexibility of the material prevents danger due to thermal expansion and contraction.

(Erinoid, Ltd., Stroud, Glos.)

Shell-moulding resins

Phenolic resins for use with the shell-moulding process in metal foundries are now being supplied by James Ferguson and Sons, Ltd. Considerable interest has been shown in this process recently and a number of automatic machines now in production should provide a large outlet of phenolic resins in this direction.

(James Ferguson and Sons, Ltd., Merton Abbey, S.W.19.)

New Fibreglass products

On the Fibreglass stand, a number of new glass-reinforced plastics mouldings were shown. These include translucent Belisha beacons by Hawley Products, Ltd., a photograph of the Galt car produced by the Galt Glass Division of Durasteel, Ltd., and a motorcycle safety helmet with flock-sprayed finish produced by Streetly Manufacturing Co., Ltd., for Feridax, Ltd. This last exhibit will be of particular interest in view of the recent statement in Parliament concerning the shortage of safety helmets in this country.

A new technical bulletin on reinforced plastics published by the company gives details of the types of glass fibre products available, a short description of various moulding techniques followed by tables of properties and some useful literature references.

(Fibreglass, Ltd., Ravenhead, St. Helens, Lancs.)

New woven glass reinforcement materials

A number of Tyglas woven glass cloths produced by Fothergill and Harvey (Development), Ltd., Littleborough, Lancs, for plastics lamination were on show at the Fibreglass stand. Of special interest are pre-impregnated cloths, i.e., treated with eporide or silicone resins for use with the dry lay-up technique; some uni-directional cloth for winding of tubular structures; satin weaves to give greater flexibility and drape as well as fine finish for the production of complex shapes; and square weaves for the production of flat laminates. Considerable progress has been made in the treatment of glass fibres and cloth prior to laminating and an improved version of the Volan treatment is now usually carried out.

(Fibreglass, Ltd., Ravenhead, St. Helens, Lancs.)

Unplasticized p.v.c. for packaging films

Flexible p.v.c. films containing no plasticizer and therefore being completely non-toxic, were shown in experimental quantities. It is hoped that these films 0.001 to 0.0015 in. thick will be in production within very few months.

Other applications of p.v.c. packaging films are continuously expanding for uses such as sealed motorcar components (both Austin and Rootes parts were exhibited) for drum liners, packing case liners, tools, etc.

(Greenwich Leathercloth Co., Ltd., St. Mary Cray, Kent.)

Silicones

Silicones in various forms, now manufactured by the Nobel Division of Imperial Chemical Industries, Ltd., were shown for the first time at this exhibition. Silicones are available in the form of fluids as damping and heat transfer fluids, water repellents, mould release agents, etc.; in the form of resins in solutions in hydrocarbon solvents for use in high dielectric strength flexible coating for glass cloth, mica-glass tape, etc.; as a bonding agent for mica and other laminated products to resist high temperatures; and as a component in specialized coating materials. Silicone elastomers are particularly useful for their flexibility over a wide temperature range and applications include bonding and coating compounds for metals, glass, plastics, etc., and electrical insulating materials.

(Imperial Chemical Industries, Ltd., Nobel Division, 25 Bothwell Street, Glasgow, C.2.)

Plastics Foamed Compounds

Some exhibits of considerable interest shown by the Ministry of Supply were the Sebalkyd resins used for making foamed structures. It is hoped to give a fuller description of these materials in a forthcoming issue of *Plastics*. Industrial uses for these materials and other techniques developed by Government Departments are being handled by the National Research and Development Corporation.

(Ministry of Supply.)

Improved impact strength polystyrene

Lustrex MI is a modified polystyrene moulding material with higher impact strength, elongation at break and deflection under three-point loading than general purpose polystyrene. Compared with other improved strength polystyrenes Lustrex MI is claimed to retain the high gloss and attractive finish of general purpose material and to lose little in tensile and flexural strength or in hardness. A number of components moulded from Lustrex MI, particularly in the refrigeration field, were shown on the Monsanto stand.

(Monsanto Chemicals, Ltd., Victoria Station House, S.W.1.)

Graphite loaded polystyrene

A new graphite loaded polystyrene material is being employed for injection moulding various water meter components for Measurements, Ltd. The moulding shown included gear assemblies, a piston chamber body and water meter filters, as well as meter housings.

(Monsanto Chemicals, Ltd., Victoria Station House, London, S.W.1.)

Epikote resins for laminating

For use with glass reinforcement, both woven and mat, Epikote resins find many applications particularly where chemical resistance combined with high strength is required, and have excellent adhesion to volan-treated glass. In combination with Fothergill and Harvey, Ltd., a number of resin-impregnated glasscloths are being produced for the dry laying up technique.

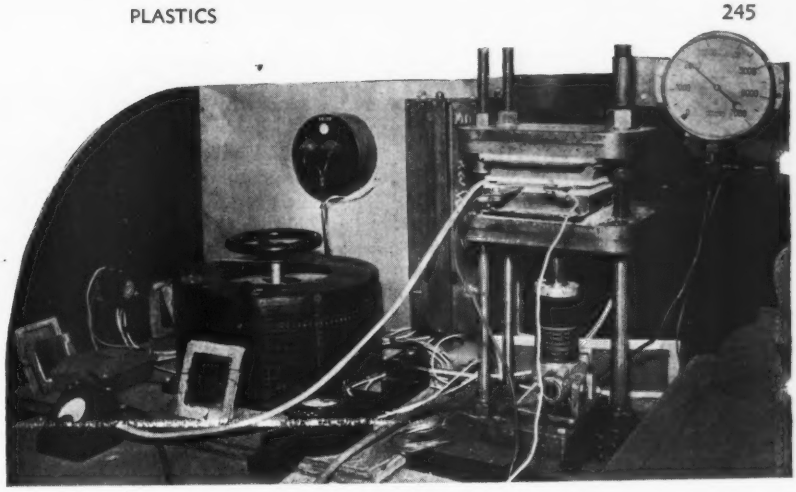
P.V.C. stabilizers

It has been found that Epikote resins in combination with conventional tester-type plasticizers provide excellent heat and light stability for p.v.c. compounds giving very good clarity.

(Shell Chemicals, Ltd., 105/109, Strand, London, W.C.2.)

Shock Cure

A significant development at the Exhibition and one which aroused great interest was the high-speed electric shock cure technique. This originated at Farnborough and is now being studied by the National Research Development Corporation. The notes which follow indicate the progress which has been made to date.



A CHANCE discovery at the R.A.E., Farnborough, has given rise to a method for curing plastic laminates in about one-fifth of the time normally required, and with a great saving in power. It was found that if a laminate—such as "Durestos"—is heated between copper platens to about 80° C., and a 230-volt alternating current passed by the platens through the material, there was a surge of current and the laminate was fully cured in a very few seconds.

The technique has been called "electric shock curing," but the theory of the process is not understood; the electricity appears to act in a more subtle role than merely to provide heat in the material. It is thought by some that the current may act catalytically, and by others that it produces an orientation of the molecules which is favourable to polymerization. The effect has been observed in a variety of resins.

Most of the experiments have been carried out on "Durestos," which is an asbestos felt impregnated with a water-soluble phenolic resin. Typical conditions for shock-curing were: platens—polished copper; pressure—200 lb./sq. in.; initial triggering temperature—120° C.; current—50 cycles A.C. mains, stepped down to 50 volts for safety.

The current rose in a few seconds to 0.5 to 2.5 amps./sq. in. and dropped to zero on its own accord. The temperature of the cured material rose to 160°-200° C. "Durestos" normally requires 15 min. curing at 160° C., 4 hours curing at 120° C. The following figures for acetone extraction are interesting: 2.5% loss in weight for normal cure, 0-0.5% loss for electric shock curing.

The technique may be modified in various ways, suitable for the job in hand. The optimum voltage to use is governed by:

(a) The dampness of the material. The damper the material, the lower the required voltage.

(b) The initial triggering temperature. Using 230 volts A.C., a triggering temperature of 60° C. could be used with "Durestos." A lower temperature would require a higher initial voltage.

(c) The thickness of the material. A laminate of "Durestos" 1 in. thick was cured in 20 minutes using 230 volts A.C. (In this case the current flowed from 5-10 minutes, most of the remaining time being taken in raising the laminate to the triggering temperature.)

(d) The electrical properties of the uncured material. Uncured resins with a high resistance require a high voltage to start the action. The process does not work with electrical grade resins, and therefore cannot be applied to manufacturing high-grade insulators.

Generally, for a given material, the higher the voltage the more rapid the cure, although for minimum power consumption there is an optimum voltage.

Varying the frequency between 50 to 500 cycles/second had little effect, but a frequency of 2,000 cycles/second doubled the curing time required. To avoid sticking or poor curing of the material, it is necessary to have perfectly clean copper electrodes. The technique works with direct current, but not well due to arcing and polarization troubles. Curved mouldings may be made. Large mouldings may be cured by heating a small portion: when the current is applied, the reaction spreads gradually and evenly over the whole object. The same result was achieved by wetting a small portion of felt: the reaction spread evenly and, apart from the wetted portion, the moulding was good. It may be possible by this means to eliminate the need for initial heating of the uncured material prior to application of the current.

It should be noted that this process has been developed only up to the advanced research stage.

VISITORS TO THE EXHIBITION

MUCH of the success of the Exhibition was due to the influx of visitors from abroad. Some were buyers, some were technologists and chemists, and some were official representatives from Plastics Associations; all must have been deeply impressed by what they saw of our industrial development. It is not possible to record all those with whom we made contact, or renewed old friendships, but the following notes will illustrate the wide diversity of lands from which they came.

Mr. Jan Erik-Jansen, Secretary of the Swedish Plastics Federation, and an old friend, led a party of 19, representing every facet of the Swedish plastics industry. The group included Mr. Tor Wiik, Director of Wiik and Hoghund A.B., and Mr. Gunnar Aggebrink, Director of the Plast A.B. Haga organization. They reported great satisfaction at their stay in London. During their visit they toured a number of plants, including the plastics division of Imperial Chemical Industries, Ltd., at Welwyn Garden City, the plant of Bakelite, Ltd., at Birmingham, and the Thornton Research Laboratories of the Shell Chemical Co., Ltd., at Chester.

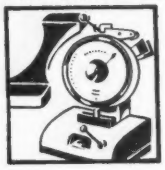
Mr. van Bockove was one of a party representing the Plastics Research Institute T.N.O. at Delft, Holland; the work of the Institute was described in the February issue of *Plastics*. Mr. van Bockove's principal task is the organization of an information service to the Dutch plastics industry and in this capacity he is a well-known visitor to many countries. Mr. van Bockove reported a wide use of our technical journals in Holland, and a keen interest in the developments in the British plastics industry.

Mr. Dobrowen, secretary of the Norwegian Plastics Association, is well known to many people in this country. He played a large part in the organization of the Norwegian Plastics Exhibition and Conference in Oslo in 1949. Mr. Dobrowen also represents the Norwegian plastics industry in the councils of the Norwegian equivalent of our Department of Scientific and Industrial Research.

One of the overseas visitors who appeared at the British Plastics Exhibition was Mr. F. S. J. Swackhamer, manager of the Resin and Plastics Department, Shell Chemical Corpn., U.S.A. On Thursday, June 18, a small party at Martinez Restaurant was arranged to meet him and to discuss the progress of Epon resins in the United States. The following were present: Dr. Manley, editor *Paint Manufacture*; Mr. Hallows, editor *Product Finishes*; Mr. Copping, editor *Paint Oil and Colour Journal*; Mr. M. D. Curwen, editor *Plastics*; Dr. Paisley, manager of the Plastics Division, Shell Chemicals, Ltd., Mr. Wheeler of the same Division, and Mr. P. J. Marsh of Shell Petroleum Co.

World's Industry Employs Plastics

MATERIALS and TESTING



Effects of vibration on phenolic foams.—H. J. Stark tested a large number of phenolic foams and found that foams with and without skin when given freedom to move inside a closed container will lose volume, shake down and powder. When used under vibrational conditions the material should be firmly bonded or retained. (A.S.T.M. Bulletin, 1953/Apr./44/Paper TP 51.)

A vinyl film commercial standard, TS 5165, covers methods of test and requirements of general purpose, plain or embossed vinyl plastic film. (U.S. Dept. of Commerce, Commodity Standards Div., Washington, 25, D.C.; *Materials and Methods*, 1953/Mar./178.)

Expanded plastics.—New developments are reported: types, trade names, producers. (*Chem. Week* (Philadelphia), 1952/Vol. 71, No. 25/32.)

Moisture resistance of insulated conductors.—R. C. Graham gives a general survey and indicates the thickness of coatings on non-lead sheaths to provide proper moisture resistance. (*Wire and Wire Products*, 1953/April/370.)

New investigations on light-metal glue joints.—K. Krekeler suggests suitable test pieces and testing methods for the strength of glued joints. Treatment has great influence on bonding strength. (*Aluminium*, 1953/April/151.)

INDUSTRIAL APPLICATIONS

Polyvinyl chloride as insulating and protecting material in the electrical industry is reviewed by A. G. Thomson, dealing with properties, chemical resistance, use for marine purposes, British and American regulations for cables, etc. (*Electrical Times* (London), 1952/Vol. 122/p. 1157.)

Foamed plastics.—H. J. Stark gives engineering test data on a number of plastic foams or cellular plastics used in naval applications. (*Product Engineering*, 1953/April/166.)

Vacuum impregnation of castings.—Castings found difficult to finish with paint, varnish, etc., due to pores may be impregnated with sodium silicate, vinyl lacquer, styrene or phenolic resin by vacuum processing. (*Products Finishing*, 1953/April/48.)

Designing with nylon.—R. Curie gives recommendation for the design of bearings and gears. (*Machine Design*, 1953/Jan./270.)

Low-pressure laminates.—R. King gives a survey of the present development of this relatively inexpensive technique by which large or complex shapes can be produced in small quantities by a simple manufacturing process. (*Machine Design*, 1953/Mar./112.)

Miniature blower scrolls for cooling aircraft and electronic equipment are produced by Electroflow Pumps Inc., of glass-reinforced alkyd plastic for reducing weight. (*Machine Design*, 1953/Mar./142.)

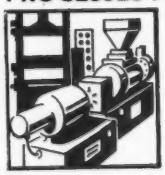
Bonded neoprene hub.—In a window-type air conditioner a high motor noise was observed. After several unsatisfactory attempts a new hub consisting of a stamped aluminium washer and a zinc die casting with bonded neoprene was successfully introduced. (*Machine Design*, 1953/Mar./234.)

Silicones and insulation—Development work at British Insulated Callender's Cables Ltd., and Midland Silicones Ltd., is described. (*Electrical Times* (London), 1953/Vol. 123, No. 3192/p. 47.)

Wire rope with a plastic core has been developed for use in drilling oil and gas wells. The plastic core replaces the fibre core now used. (*Science News Letter*, 1953/April 25/264.)

Helicopter rotor blade is shaped from a cellular plastic. All the stress is carried in the outer skin, filled with a relatively weak material. (*Science News Letter*, 1953/April 11/232.)

PROCESSES : MACHINERY



Short-run plastics tooling. — Various possibilities for reducing tooling time, lower tooling costs and the use of plastic dies are discussed. (*Iron Age*, 1953/Feb./115; *McGraw Hill Digest*, 1953/May/20.)

Engraving on plastics is a new method of reproducing maps. Line-scribing is on an opaque coating on a semi-rigid transparent plastic sheeting such as acrylic. (*Science News Letter*, 1953/Apr. 4/213.)

Metal bonding.—A report on current practice has been given by O. W. Loudenslager. The properties of typical bonding adhesives are discussed, and a variety of reinforcements discussed to overcome the weakness of sandwich cores. (*Tool Engineer*, 1953/Apr./78.)

Welding of plastic foils.—C. Lorenz, A.G., Stuttgart/Zuffenhausen, has developed new improved high-frequency welding equipment for plastics. (*Feinwerktechnik*, 1953/No. 2/58.)

Extrusions.—Processes, machines and materials are discussed. (*Machine Design*, 1953/Mar./145.)

MISCELLANEOUS USES

A vinyl plastics case gives to a new model of the Synctron electronic flash produced by Dormitzer Electric and Mfg. Co., Inc., easier portability, greater strength and increased safety. (*Materials and Methods*, 1953/Mar./100.)

Plastics for stress-optical investigations.—R. Landwehr gives a general survey on plastics suitable for these investigations, mainly from the point of view of the optician. (*Optik*, 1952, Vol. 9, 547.)

Boats.—W. Fiedler describes new plastic models. (*Hansa*, 1953, Vol. 90, 528.)

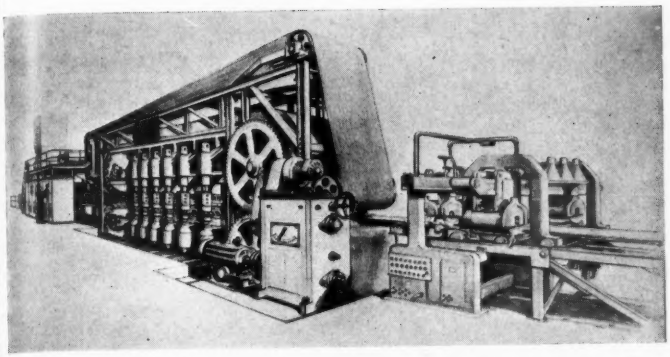
Butyl-impregnated leather.—Soles impregnated with polyisobutylene have the same greatly improved abrasion and water resistance as those containing rubber. Increase in resistance is about 80%. (*Technical News Bulletin*, 1953/Mar./44.)

Scintillation plastic produced by National Radiac Inc., 10 Crawford Street, Newark 2, N.Y., is sensitive to gamma, beta, alpha, X-rays and ultra-violet light. The decay time is 1.0×10^{-8} sec. (*Nucleonics*, 1953/April/76.)

Cutting paper sections was made possible by embedding them in polythene. Great advantages are obtained over usual methods, of embedding in paraffin wax or cellulose nitrate. (*Research Correspondence*, 1953/May/345.)

P.V.C. in Norway.—N. H. Nyquist gives a survey of the properties and applications (*Tidsskrift for Kjemi, Bergvesen og Metallurgi*, 1953/Mar./27.)

Vacuum cleaners.—A bibliography of 15 references to articles published recently in the U.S. is included in this brief note which states that plastics are being used to an increasing extent in the U.S.A. for the construction of vacuum cleaners. (Question and Answer Service Report, Office of Technical Services, Washington. T.I.D.U. Microfilm, Ref. IR9786.)



The Bartrev Press

In the course of development over a number of years, the first of the Bartrev Presses is now completed and in operation. The illustration shown at left gives some idea of this giant plant for the continuous production of board material bonded with a synthetic resin. The notes which follow describe the essential features of the press and give some indications as to the type of board produced.

FOR many years technicians have sought a means of using the waste wood of the world—of all the timber felled perhaps only half finds its way into finished articles such as tables, chairs, pit props and joists. The rest is largely waste. Sometimes it is used as a fuel, some is converted to charcoal, but vast quantities are regarded as useless by-products of an essential industry.

The problem has been to develop a machine which will absorb some of this waste material, producing a commodity having a market value. An obvious usage during the past years of acute timber shortage has been in the production of a board capable of use in structural applications. This would now appear to have been achieved, with the aid of a machine the prototype of which was described in the December issue of *Plastics* for 1948.

The Bartrev press has many features in common with a paper-making machine. Essentially, wood waste from saw mills at factories, and cuttings, tops and branches from the lumber industry, is bonded under heat and pressure with a synthetic resin, to produce a board of the required thickness and density.

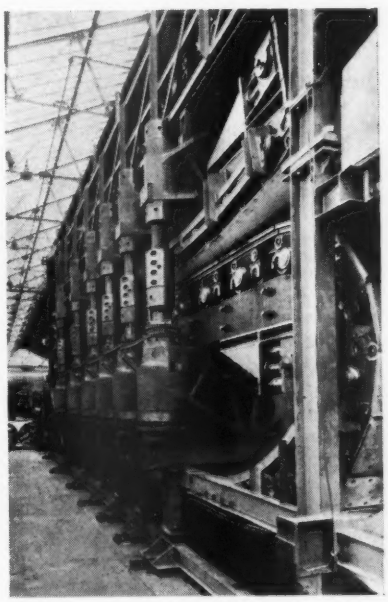
The continuous press comprises two endless heated platen chains and two endless polished stainless steel bands face to face the one above the other. The raw material carpet is carried on the lower steel band through the h.f. heating field to the press.

The patented features of this part of the process included the design and motion of the platen chains so that their edges cannot damage the steel bands, and the distribution of pressure when the wood-resin carpet enters the press. The compacting process consists of two stages, the first being the expulsion of air from the voids and the rearrangement of the particles to fill the voids and the second being the actual compression of the particles themselves. Of these stages the last requires considerable pressure, but after it has been completed and curing of the resin has started, only relatively little pressure is required for holding the board at its correct thickness and to prevent recovery.

The final heating stage which has to be effected in the press by transfer from the radiant-heated platens raises the temperature of the raw material to a total of 110° C.-115° C according to the type of board to be produced. This temperature is maintained by thermostatic control until the raw material leaves the pressure zone as fully cured, fully compressed Bartrev board.

The polished steel bands are carried on steel drums, four to each band. Tension is applied to the bands and automatic adjustment to the drums is provided to ensure true parallel movement. Provision is also made to ensure that contraction of the bands on cooling does not introduce any risk of overstressing either the bands or the drums. The entire press is driven by an electric motor operating through a gearbox permitting speeds of between 5 and 30 ft. per minute. This is one of the factors which gives the Bartrev process great versatility, since speeds can be calculated to correspond with varying raw materials, resin contents, thicknesses and densities. Devices for carrying rolls of paper and applying the paper to one or both sides of the board are incorporated in the press. The paper is coated with resin and fed into the steel bands prior to laying the wood-resin carpet.

At the delivery end of the press automatic saws are fitted to perform two operations: first, the edges of the board are automatically trimmed as it emerges from the press; secondly, a saw operating in a transverse direction square cuts the moving board to any required length.



The pressurizing unit in the press, adjustable to give the requisite thickness and density.

The board is workable by normal joinery methods, employing hand or machine tools. It can be cut, sawn, nailed and glued like wood. As in the case of plywood, it is advisable to use thinner nails and to avoid nailing too close to the edges. Screw fixing is facilitated by pre-drilling. It can be glued or jointed with ordinary Scotch glue, casein or any synthetic resin glues, and can be butt- or scarf-jointed., etc., in the usual way.

Finishes

The standard board can be made either with or without a low-cost paper surface. The unfaced board provides such a smooth surface that an excellent washable finish can be given simply by waxing or applying transparent varnish or cellulose, thus retaining the attractive and characteristic wood particle structure.

For paint or distemper no preliminary filling is required but undercoats are always advisable. For flooring, special transparent finishes are recommended to increase hardness and moisture resistance. The plain paper surface which can be applied during manufacture provides a perfect key for brush or spray painting.

Special Finishes

Any of the normally acceptable surfaces that can be veneered onto plywood or blockboard can equally well, and by the same methods, be applied after manufacture and when cut to standard sizes.

Applications

In a world in which cheap but dependable board is a very desirable commodity, the future would appear satisfactory and there seems to be no reason why boards and core materials produced on Bartrev machines will not become standard structural materials in at least five principal industries, building, furniture, ship-building, railway-coach construction, and coaches and commercial motorcar body building. The direct use of a synthetic resin of its heat-curing type marks another significant development in the plastics industry.

The Bartrev press is the culmination of many years intensive research on the part of Mr. W. J. Fischbein, managing director of the Vere Engineering Company, Vere Street, London, W.1, and his colleagues. Backed by the Sassoon banking organization, the project was in the course of development before and during the past war. In June, 1952, the 200-ton, 131-ft. long machine, the first full-scale plant, rolled out a continuous board over 4 ft. wide ¼-in. thick, at a speed of 20 ft. per minute.

A recently formed company, specializes in the coating of plastics mouldings by the vacuum evaporation technique. Particular emphasis is placed on the importance of correct selection and methods of applying lacquers to the mouldings before coating and subsequently to the finished metallized article. The relative merits of various metal coating techniques are also discussed.

Metal Coating for Plastics

New Trade Service for Vacuum Evaporation of Metallic Films

THE attractive finishes of polished metals have often decided the adoption of metals for a particular job, where otherwise the ease of large-scale production or some specific properties required would have called for the use of a plastic material. Plastics manufacturers have always taken a keen interest in the various processes which have been developed in the past of giving a metallic finish to plastics mouldings. These methods have included the incorporation of metallic powders into moulding powders and various surface treatments such as silver reduction and electrolytic deposition. One of the latest coating treatments to be developed is the vacuum evaporation of metals. W. Edwards and Co. (London), Ltd., Sydenham, London, S.E.26, are producing a number of vacuum units suitable for coating plastics, and several plastics manufacturers have already adopted the process. There has, however, been some reluctance on the part of other manufacturers, partly because of the high initial cost of the vacuum equipment and partly because, despite its essential simplicity, considerable technical knowledge, skill and experience is required to operate this process satisfactorily.

About a year ago a company was formed (V.M.C., Ltd., 54 Alderton Road, Croydon, Surrey), solely for the purpose of carrying out vacuum metallization as a trade service for those manufacturers who are unable or unwilling to install their own plant and equipment. The following notes and illustrations describe the process as it is performed by this company.

The first stage of processing takes place in the fixtures department where the articles to be treated are mounted on jigs so that they may be handled in bulk. These jigs are metal bars so designed that some 30 small articles can be mounted on each one and taken right through all stages in the process so that they need not be touched until they are removed for inspection and dispatch. All the equipment—vacuum chambers, ovens, trolleys, etc.—is fitted with racks designed to take the maximum number of jigs.

The jigs with the work mounted on them are first immersed in a series of degreasing baths to ensure complete removal of foreign matter which might prevent adhesion of the base lacquer which is subsequently applied. When the work has been thoroughly degreased and dried, it is passed to the next stage where a base coating of lacquer is applied to the mouldings. This can be done by spraying, particularly when large and awkward shapes are being handled, but dip coating by immersion in the lacquer solution and gradual withdrawal by means of a hydraulically controlled dipping machine is preferred for its simplicity and efficiency.

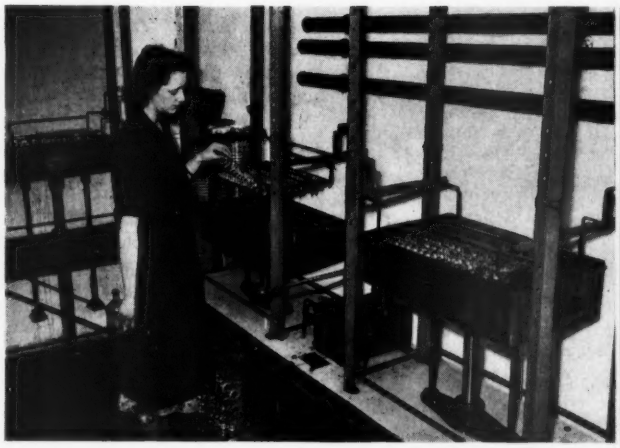
This lacquer film performs several functions, and the correct selection of a type suited to the requirements of a specific material and job is one of the greatest arts in vacuum coating. The film must provide a very high surface finish, since the evaporated metal film faithfully reproduces every feature of the base and blemishes are readily seen; it must seal off any porosity in the base material because at the very low pressures employed during evaporation, gases from any pores in the material would tend to produce bubbles or blisters in the film; it must normally be of the stoving polymerizing type so that it becomes fully cured and able to resist attack from the second coat of lacquer which is applied after metallization; it must cure rapidly at temperatures in the region of 50° C. as thermoplastic injection-mouldings would soften and distort at temperatures much in excess of this. The film must, of course, be inert so as not to attack the metal and free from vostiel matter to prevent bubbles and blisters as explained.

At the conclusion of the stoving period the work is ready for the vacuum chamber. The actual process of vacuum evaporation was described recently in *Plastics* (March, 1953, p. 96) with reference to the Edwards Model 24E, one of which is in use at V.M.C., Ltd. This involves the electrical melting and vaporizing of the metal, usually aluminium in the form of small loops of wire, at a pressure of 10^{-4} mm. of mercury or lower, and the subsequent condensation of the vapour on the surfaces to be coated. Metal vapour molecules leaving the source have very few or no collisions with air molecules at such low pressures, and consequently they travel in straight lines and coat everything in their direct path. Where articles are to be coated on all surfaces as is usually the case, racks within the vacuum chamber are designed so that they can be rotated from outside, either manually or by means of a small electric motor, in order to turn the jigs and to present all surfaces for coating.

The metal film applied in this way is only a few molecules thick, and in order to protect it from rubbing or other attack a second coat of lacquer is applied to all metallized articles. Here again correct selection of the type of lacquer used is very important as the final appearance and wearing properties of the product largely depend on it. Air-drying or stoving lacquers could be used, but the advantages of the latter are so great that this company has adopted their exclusive use.

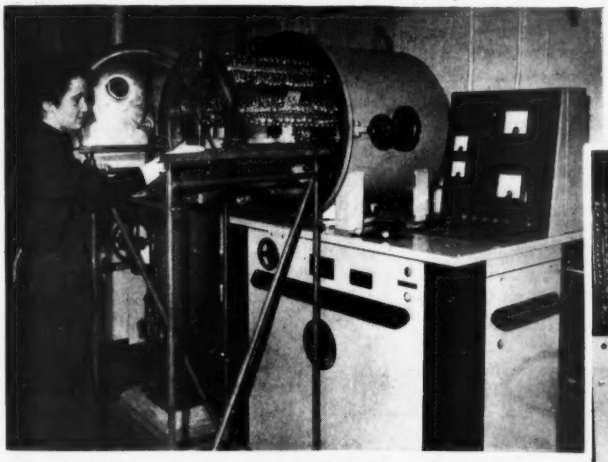
After this stage all metallized articles have a highly lustrous "silver" finish, which is desirable for many applications. By dipping the finished products in a dye-bath, all kinds of gilt and "anodized"

METAL COATING FOR PLASTICS

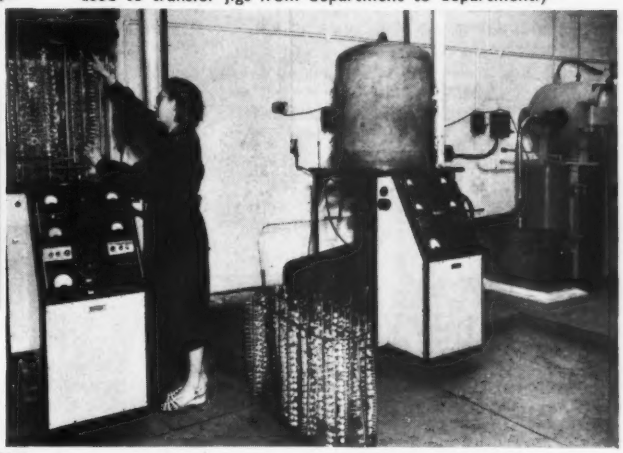


1.—Jigs loaded with articles to be metallized are placed on racks prior to dipping in the base lacquer solution.

2.—The dipped mouldings are transferred to the drying ovens for stoving. (Note the trolley in the foreground used to transfer jigs from department to department.)

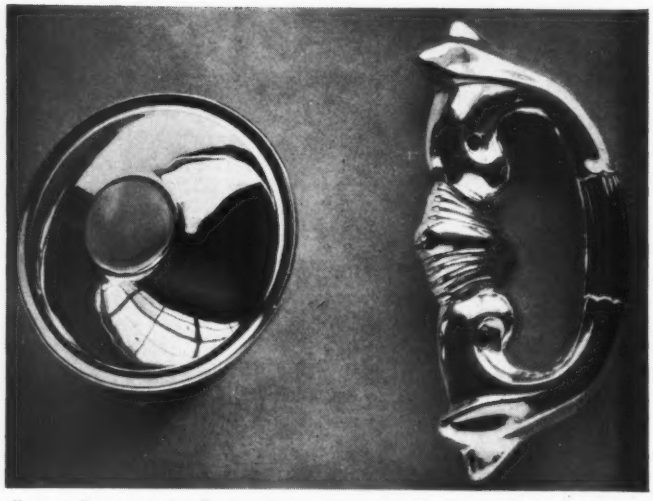


3.—Work being placed in the vacuum chamber. The fixture rotates within the chamber so that all surfaces are coated evenly.



4.—Machines and operators are employed most efficiently by loading one chamber whilst the others are being evacuated.

5.—After receiving a final coat of lacquer to protect the metal film, the work (pen caps are seen in the foreground above) is removed from the jigs and (6, right)—laid out for inspection and packing.



Headlamp reflectors and coffin handles are examples of metallized plastics applications.

effects can be obtained in many colours. Finally, coated objects are removed from the jigs and laid out for inspection. In the few cases where blemishes occur in the coating, the article may be taken through the complete process again without any harmful effects.

Applications

The applications of the metallization of plastics all come into the category of cases where some properties of plastics, such as lightness, ease of production or cost can be combined with the attractive appearance of a lustrous metallic surface. By far the largest use lies obviously in the mass production of brooches, buttons, buckles, hairslides, hat pins and similar fashion accessories where a moulded product can be produced at less cost to give more effective service than the equivalent metal product.

A somewhat different and unusual application for metallization is in the decoration of coffin furniture. Here, the use of bronze or chrome-plated metal has been almost universal, but the presence of metallic fittings on coffins was found undesirable for cremation. One manufacturer of such fittings has therefore changed his production to injection moulded plastics, which are subsequently metallized.

Other examples of useful applications are found among the products treated by V.M.C., Ltd. These include plastic headlamp reflectors, pen caps, door handles and knobs, toys and radio components. The so-called "three dimensional" insignia and nameplates now used on many cars and refrigerators also make use of metal coating. The type of wear that is obtainable if a good stoving lacquer is used with a suitable base material is demonstrated by the experience of one large store's testing department which subjected vacuum metallized plastic buttons to prolonged boiling in detergent solution and found no harmful effects on the buttons.

It is stressed that for the production of a sound vacuum metallized product, co-operation between the moulder and the company undertaking the coating is very desirable. Frequently slight alterations in design, having little or no effect on either moulding conditions or on the appearance of the moulding, will enable a coating to be achieved more efficiently in less time. With such co-operation between plastics manufacturers as potential users of the vacuum metallizing process and the vacuum coating company many new fields of application, both industrial and ornamental, could be explored.

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Second-hand Moulds

SIR,—As moulders of different kinds of thermoplastic and thermosetting moulding we would be very glad to know if you can give us the names and addresses of firms able to furnish us different kinds of injection and compression second-hand moulds in good working condition. Such as injection moulds for men's buttons, spectacle frames, etc., and compression moulds for electrical appliances.

KOROZO DUGME FABRIKASI.
S. M. Arditi.
Kurtulus Turk Begi Sokagi
No. 118-130,
Istanbul, Turkey.

P.V.C. Footballs

SIR,—I would be very grateful if you would let me have the name of the manufacturer of plastic footballs (p.v.c.), the kind which are already on the market in France and Germany. I understand the football is made in Birmingham but I have been unable to locate the address.

The concern interested in this product is Firma Plastman, F.D. Sodra Station, Gavle, Sweden, a wholesaler in plastic articles.

RICHARD D. FISH.
190 Edgwarebury Lane,
Edgware, Middlesex.

Mosquito Netting

SIR,—Our principals in Peru, owners of sugar-cane plantations, have requested us to obtain for them samples and full details of plastic mosquito netting and we shall be extremely grateful if you will kindly furnish us with names and addresses of manufacturers whom we could approach in this connection.

WM. AND JNO. LOCKETT, LTD.
30 Exchange Street East,
Liverpool, 2.

Plastic Hair Curlers

SIR,—We have been trying to obtain supplies of plastic hair curlers suitable for home permanent waving, unfortunately without success. It is quite possible that you know a company which has a suitable mould and is in a position to let us have supplies.

B. N. FURMAN (PRODUCTION), LTD.
565 Green Lanes,
London, N.8.

Polythene Bottles

SIR,—We notice in the August, 1952, issue of *Plastics*, page 238, illustrations of exhibitions at Castle Bromwich by members of the British Plastics Federation.

One illustration in particular is that of polythene containers and bottles made by Cascelloid, Ltd. Their address does not appear anywhere in your magazine, and we are wondering if you would be kind enough to give us this information or forward this letter to them. We are interested particularly in an eight-ounce round polythene bottle with a 28-mm. thread. It is possible that this company may have a Canadian representative, if not we would be very grateful for quotations on 10,000, 25,000 and 50,000 without tops, in natural colour, and if possible a sample bottle.

BEACON PLASTICS, LTD.
St. Hyacinthe,
Quebec, Canada.

New Productions

New Packaging Devices

Two new developments in the use of plastics in packaging have been reported recently by Universal Metal Products, Ltd., Langley Road, Pendleton, Salford, Lancashire A polythene tablet container has been specially designed to release one tablet at a time, and can be used with only one hand. The cap of the container is fixed to the body by a hinge consisting of a flexible piece of polythene being integral with the main body of the moulding, and a plug which fits into the cylindrical body forms the base of the container and facilitates filling. The size at present available is suitable for standard 5-grain aspirin tablets but other sizes are in the course of preparation, and special sizes can be made.

The " 3-point " wadless tube closure is a new device for collapsible tubes having three new features. First there are no loose caps after filling, secondly by the shape of the cap a positive " closure " is obtained which gives the third advantage of obviating the need for washers. The device has been patented (B.P. 571,448) and patents in other countries are pending. The closure has already been adopted by a number of important companies and is under close examination by other leading tube users.

(Right) Celluloid knife handles.

Knife Handles

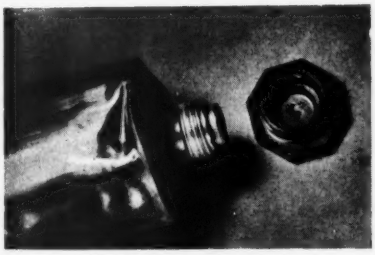
The oldest material in the plastics industry, celluloid, still finds applications where good appearance, surface finish, stability and water resistance are important. These knife handles made by Sanders and Bowers, Ltd., Sheffield, are fabricated from horn, grained and pearl-type Xylonite material made by BX Plastics, Ltd., Higham Station Avenue, Chingford, London, E.4.

Plastics-covered clothes-lines

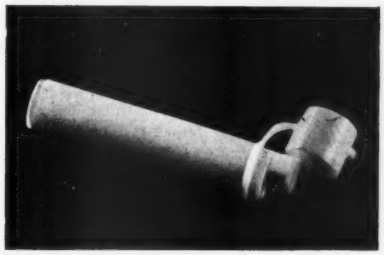
By extruding a sheath of Vybak polyvinyl chloride (made by Bakelite, Ltd.) over a conventional clothes-line a hygienic and washable line has been produced. A plastics cover gives the line non-sagging quality, the resistance to ageing and weathering, so that it may be left out at all times. The clean, polished surface of the exterior of the extrusion enables the line to be cleaned merely by wiping with a damp cloth. The manufacturers of the clothes-line are Litchfield Bros., Ltd., Belpar, Derbyshire.

Voltage Tester

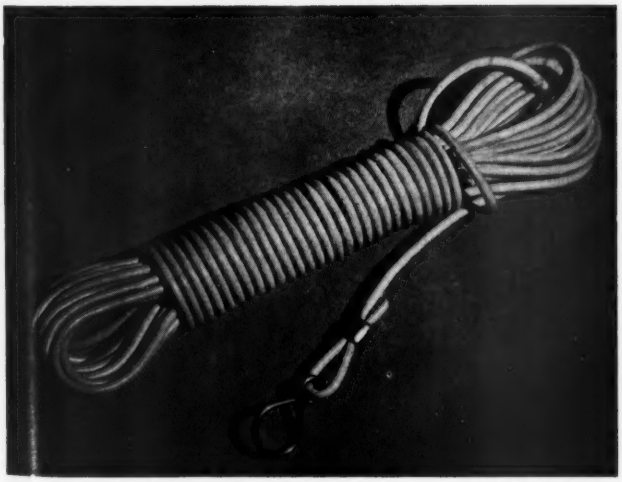
The new model 53 voltage tester developed by Martindale Electrical Co., Ltd., Westmoreland Road, London, N.W.9, makes use of a number of high acetyl cellulose acetate mouldings. Both the body and the prods of the instrument have been moulded in this material by Punfield and Barstow (Mouldings), Ltd., Westmoreland Road, London, N.W.9. These mouldings combine good electrical properties and low moisture absorption with a high degree of toughness. The cables leading from the body of the instrument to the prods are covered with thick p.v.c. insulation. A feature of interest is the moulded plastic bobbin which contains over a mile of wire to provide high resistance and low rating. The coils are attached to moulded-in terminals into which the cable leads are screwed. Other points of interest are the spring-loaded retractable sheets for the prods, the improved legibility of the indicator due to a built-in magnifier, and the built-in fuses for the prods.



Wadless tube closure.



Tablet container



(Above) Flastics-covered clothes-line.

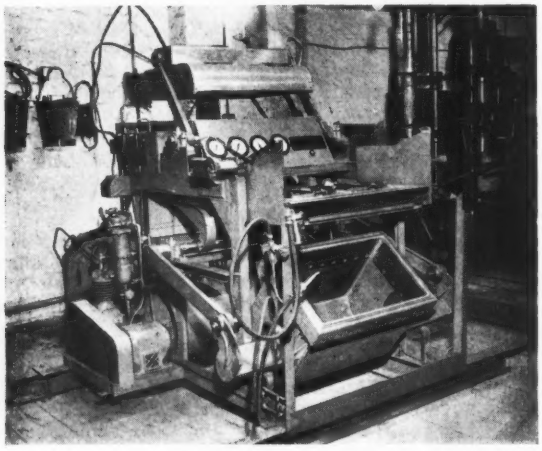
(Right) Voltage tester.

Plastics NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

AUTOCLINO SHELL MOULDER.—Although the technique of shell moulding is not new, this is the first British designed and made machine which is fully automatic in action, and capable of producing highly finished moulds in rapid succession once the timing devices have been set. The operation of the machine is simple. After a preliminary run with the pattern plate to ascertain the length of the various time cycles involved, the timing devices are set to reproduce this cycle.

Providing the various time cycles have already been set for the particular pattern plate in use, the master time switch will take over the operation for making a single shell mould. The general process of operation is as follows:—1. The pattern plate is loaded. This plate is mounted on two dowelled studs, and clamped with two hexagon nuts. 2. The heating hood swings over the pattern plate and applies infra-red heat for a predetermined period. 3. The hood swings back and the pattern plate is reversed ready to meet the dump box containing the sand/resin mixture. 4. The dump box rises to meet the pattern plate. 5. Dump box and pattern plate are turned completely over to enable the sand/resin mixture to invest the pattern. After a set period, this movement is reversed to allow surplus mixture to fall back in the box which is then lowered away from the plate. The pattern and its investment now turns over to its original position and the heater hood swings over it for the final cure. After a set time the hood returns to its stand. 6. The dump box is lifted up to the ejector plate which engages with the ejector pins and so raises the shell mould approximately 2 in. and holds it off the plate for any predetermined time. The machine is manufactured by Clino Foundry Supplies, Ltd., 25 Clyde Vale, London, S.E.23.



View of the Autoclino machine.

ATTENDANCE AT THE B.I.F.—The next British Industries Fair will be held in London and Birmingham from May 3 to 14, 1954. The announcement was made by the President of the Board of Trade at the same time as he told the House of Commons that he had set up a Committee to consider the future of the Fair.

Particular interest therefore attaches to the B.I.F. which ended earlier this month. Although it is impossible to assess the value of business done, some idea of the success of the Fair can be gathered from a close examination of the attendance figures. These show that nearly 30% more people came to the London sections, at Earls Court and Olympia, than in 1952. There was an increase of 95% in public attendance (20,247 to 39,001) and of 3% in trade buyers, (56,066 to 58,919). Home buyers were responsible for this increase, since the number of overseas buyers was slightly fewer (11,593 to 11,045) although it should be remembered that this is more than twice the average number who came to the pre-war Fairs. The overseas buyer travelled an average of 6,000 miles to the Fair and back to his home. Only 1% of them were here for the Coronation. Earls Court, with only a third of the London exhibitors, greatly increased the number of buyers it attracted, in comparison with previous Fairs. In fact, more overseas buyers (5,707) came first to Earls Court than to Olympia (5,338). Another unusual trend is that attendances in the last days of the Fair were greater than usual. On the closing day, when there was no public admission, 3,704 visitors came to the London sections of the Fair, compared with 1,660 in 1952.

NEW "TERYLENE" PLANT TO BE DOUBLED.—I.C.I. have decided to double the size of the "Terylene" fibre plant now being built at Wilton, Yorkshire. The original plant, with a scheduled capacity of 11 million lb. per year of filament yarn and staple fibre, is due to commence operation early in 1955, and the new extension will be ready a year later. This will be possible because when the original plant was designed plans were made for rapid extension should this be required. For the past three years the supplies of "Terylene" have been limited to the output of the pilot plant near Fleetwood. This output has been used for evaluation and testing of a great range of potential uses for "Terylene."

LOYAL GREETINGS FROM THE BRITISH PLASTICS FEDERATION.—Mr. C. S. Dingley, Chairman of the British Plastics Federation, has kindly made available to us a copy of a letter sent to Her Majesty the Queen on behalf of the plastics industry. This we print with great pleasure below, together with the reply of Her Majesty's Equerry.

29th May, 1953.

To The Queen's Most Excellent Majesty,
Buckingham Palace,
London, S.W.1.
Madam,

May it please Your Majesty on the occasion of Your Coronation to accept the good wishes and loyal greetings dutifully submitted by us on behalf of the Plastics Industry which this Federation represents.

It is our earnest prayer that Your Majesty's reign may be long and happy and blessed throughout with peace and prosperity.

We remain,
Your Majesty's faithful and dutiful servants,

C. S. DINGLEY, *Chairman.*
W. E. DE B. DIAMOND, *Director.*

Buckingham Palace.
9th June, 1953.

Dear Sir,

I am commanded by The Queen to thank you for the kind message which you have sent on the occasion of Her Majesty's Coronation. Please convey to all on whose behalf you wrote, an expression of The Queen's sincere appreciation of their loyal sentiments.

Yours sincerely,
(*Sgd.*) MARTIN CHARTERIS.

The Chairman,
The British Plastics Federation,
47/48 Piccadilly.
London, W.1.

A PLASTICS CENTRE IN SPAIN—We have received details and plans for the development of a Plastics Centre, the office of which is at Paseo de Gracia, 25, Barcelona 7. The Centre invites participation by organizations, including manufacturing concerns, outside Spain, in the capacity of Patron Members. Organizations co-operating are offered the hope that by sending samples and products, trade relations with Spain will be consolidated.

Mr. F. S. J. Swackhamer, whose visit to London is reported on page 245.

THE PREVENTION OF STICKING ON CONTINUOUS FEED-THROUGH ROLLERS.—The Edison Swan Electric Co., have introduced an entirely new, patented process whereby rollers and other cylindrical parts can be coated with polytetrafluoroethylene (p.t.f.e.). This process should be of particular interest to food manufacturers and others using continuous feed-through rollers as the properties of p.t.f.e. are such that sticking and contamination are virtually impossible.

F. J. EDWARDS LTD. have published a new leaflet, No. 129C, which describes the Besco gang slitting machine. Although designed for the sheet metal working industries, it is ideally suited to the cutting of resin-bonded sheets and boards. The design incorporates the latest techniques. Shearing cutters are of high-grade alloy steel, feed out rollers are supplied as standard equipment and the clutch is of the internal expansion type having non-slip operation.

ERINOID POLYSTYRENE MATERIALS—is the title of a new publication recently sent to us. The booklet outlines the properties of each of the types of polystyrene marketed by Erinoid, Ltd., and is well illustrated by photographs of mouldings. Equally important is the technical data and a very useful appendix describing the nature and cure for several moulding faults.

A very useful booklet to all who employ polystyrene in fabricating processes.

ACTON TECHNICAL COLLEGE.—A course of twelve lectures on "The Chemistry of High Polymers" will be held in the Department of Chemistry and Biology on Wednesdays, at 7.30 p.m., commencing on September 30, 1953. The course will include lectures on the physical properties of high polymers, methods of molecular weight determination, properties of polyelectrolytes, utilization of high polymers in industrial processes. The course will be of value to industrial chemists, research workers and others engaged in industries connected with utilization of plastics materials or other applications of high polymers. The fee for each course is 30s. Further information and forms of application may be obtained from the Principal, Acton Technical College, High Street, Acton, W.3.

MONSANTO CHEMICALS LTD.—Mr. P. A. Singleton, managing director of Monsanto Chemicals Ltd., has announced the transfer of Mr. J. M. Kershaw to the Overseas Division of Monsanto Chemical Co., St. Louis, as its London development representative. He will be stationed in London and will be responsible to Dr. W. D. Scott, director of development of the Division. Mr. Kershaw joined Monsanto as a chemical engineer in the engineering department in London, having previously been plant manager of an Indian munitions factory. After carrying out a number of projects in London and Newport he was seconded to Forth Chemicals Ltd. as project manager, with overall responsibility for the construction and commissioning of the new styrene monomer plant which recently achieved full production rate.

ELLIOTT BROTHERS (LONDON), LTD., manufacturers of electrical, electronic and process control instruments have transferred their Newcastle branch office to 36 Scottwood Street, Newcastle-on-Tyne.

NEW PRESIDENT FOR U.S. BAKELITE CO.—Mr. George C. Miller has succeeded Mr. H. S. Bunn as President of the U.S. Bakelite Co. Amongst the positions he has previously held are those of general sales manager of the thermo-plastics department of the company in 1944 and vice-president and general sales manager of the whole company in 1945.

Mr. George C. Miller

TELCON TELECOMMUNICATIONS LTD.—Captain Reginald Trevor Paul, C.B.E., R.N.(ret'd.), A.M.I.E.E., commercial manager of the Equipment Division of Mullard Ltd., has been appointed a director of Telcon Telecommunications Ltd., by Mullard Ltd., in place of Dr. D. B. Foster, who has resigned from the board owing to pressure of work in other directions.

PLASTIC BOWL USED ON EVEREST CLIMB.—B.E.F. Products (Essex) Ltd., of London Road, Leigh-on-Sea, Essex, manufacturers and distributors of plastic household articles, announce that their 14-in. diameter polythene bowls were used by members of the recent successful Everest Expedition. These bowls, being light and unbreakable, were ideal for this purpose. They were manufactured for B.E.F. by E. K. Cole, Ltd., Southend-on-Sea, who now market this product jointly with B.E.F. under the name of the Ekco "Plastabowl." The bowls were supplied to the organizers of the expedition by the hardware factors—H. E. Waring and Co. Ltd., 2 Holborn Buildings, Holborn, London, E.C.1.

HERALDRY FOR BEGINNERS.—We had the pleasure to receive a few days ago an amusing and beautifully printed book, "Simple Heraldry." It is published in a private edition by Tullis Russel and Co., Ltd. (with the permission of Thomas Nelson and Sons, Ltd.), the well-known paper manufacturers. Apart from its lighthearted approach, it is full of information which will appeal to all interested in heraldry.

BRIGADIER J. B. HICKMAN.—With deep regret the death is announced of Brigadier John B. Hickman, C.B.E., M.C., M.A., on June 3, 1953. He was managing director of British Telecommunications Research Ltd., deputy chairman of A.T. and E. (Bridgnorth) Ltd., a director of Automatic Telephone and Electric Co. Ltd., and a director of Hivac Ltd. He was appointed Deputy Chief Inspector of Telecommunications at the Directorate of Electrical and Mechanical Equipment in 1941, and was seconded to the Ministry of Supply in 1945 as Director of Research and Development, Telecommunications. He became managing director of B.T.R. Ltd. in 1949. In April, 1950, he received the Diploma of Officier de la Legion d'honneur.

MR. SHURE.—We learn with great regret of the recent death of Mr. Julius Shure, Joint Managing Director of the Mentmore Manufacturing Co., Ltd. Mr. Shure had, for over 30 years, been a dominant figure in the progress of his companies, and had a most energetic influence over their sales.

BOOK REVIEW

THERE are many artists today who bewail the little use that has been made so far of plastics materials as a medium for sculpture. Only on comparatively rare occasions have we been able to record in the pages of *Plastics* examples of the sculptor's art; a notable example was the corn cob executed in acrylic material for Brown and Polsons, Ltd.

We therefore read with our critical faculties alert "Plastics for the Home Craftsman," by Rodney Hooper, M.S.I.A., product designer to Lacrinoid Products, Ltd., and well known in the plastics industry for his work in this field. How, we wondered, would a craftsman of some repute and experience in our own industry treat this subject?

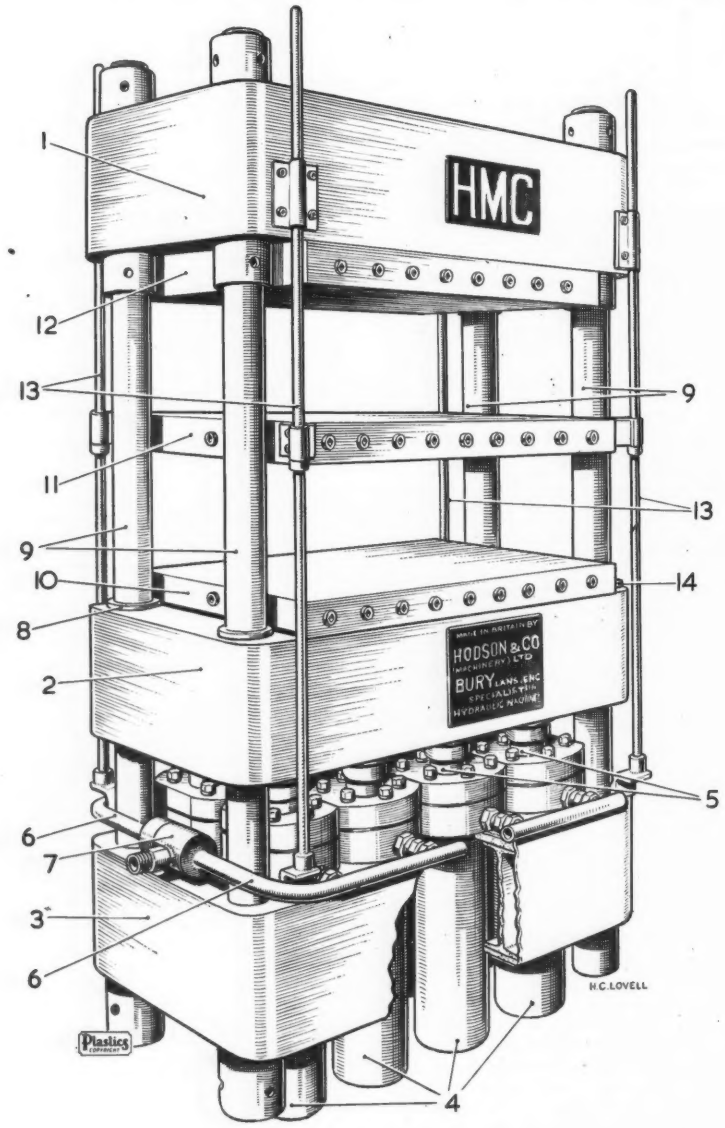
The answer can perhaps be best explained by pointing out that the author has sensibly stuck to the main point at issue, the use of plastics by the home craftsman. The standard Mr. Hooper has set the amateur is by no means low. Beautiful illustrations demonstrate some of the expert's work, ranging from the embedding of flowers to the demonstration model in transparent material of a fuel injection pump. The latter item marks the catholic approach made by the author to the subject. Not only are clear and concise directions given for the fabrication of a cigarette case; the industrial aspect is also fully covered. And here it is as well to remember that the word "amateur" is often a misnomer. Anyone who has visited the Model Engineers' Exhibition will appreciate the wealth of artistic talent possessed of the spare-time amateur craftsman.

We appreciated the sensible introduction to the field of plastics. Here was no woolly attempt to serve up the gist of one of our most complex industries in easy-to-read and misleading language. After a very brief historical resumé, the reader is told which are the most useful materials for craft work and modelling, where he can get them and what form they take. "Plastics for the Home Craftsman" is published by Evans Brothers, Ltd., Montague House, Russell Square, London, W.C.1, price 12s. 6d.

Machines for the Industry

Hodson All-steel Multi-ram Hydraulic Press

A New Press Developed and Built by Hodson and Company (Machinery), Ltd., is Described in this Article. The Multi-ram Principle is Employed to Achieve Greater Accuracy of Moulding.



1.—All-steel head. 2.—All-steel table. 3.—All-steel base. 4.—Cylinders. 5.—Rams. 6.—Feed pipe. 7.—Inlet junction box. 8.—Table bush. 9.—Columns. 10.—Platen (fixed). 11.—Platen (floating). 12.—Platen (fixed). 13.—Platen guide bars. 14.—Adjusting collars.

IN the manufacture of large moulded products or laminated materials by means of compression in a hydraulic or mechanical press, a common disadvantage has hitherto been lack of stability in the salient portions of the machine itself, causing imperfect mouldings to be formed. This movement is known as deflection and usually takes place when the moulding is under total pressure, and is indicated by the fact that the resultant product varies in thickness. Many factors contribute to cause deflection, especially in presses having a large table or platen area. A conventional hydraulic press usually consists of one cylinder and ram for table movement and as this is located centrally in the table, the obvious area of deflection will be outside the periphery of the ram. If this is a large area the movement may have a serious effect on the quality of the moulded article.

To overcome these defects in press design the machine illustrated has been developed by Hodson and Co. (Machinery), Ltd. Unlike conventional presses manufactured mainly of cast iron or cast steel, the unit is made from steel throughout, the head (1), table (2) and base (3) being completely fabricated and specially " normalized " by heat treatment so that the structural stresses are uniform throughout. This method of construction ensures a much stronger component since a frequent cause of casting failures is porosity. An added advantage of fabrication is that the press can be designed to meet any dimensional requirements at lower cost. The applied pressure is completely equalized over the whole area of the table by means of multiple cylinders (4) containing the rams (5), and it is these combined factors which reduce deflection to a minimum. The number of rams used is governed by the total capacity of the press and the table area, the press illustrated being of 300 tons capacity and having a table area of 4 ft. 6 in. by 3 ft., the number of rams in this case being eight. Four of these are used as pre-fill rams to effect quick closure of the press and these afterwards combine with the remainder to give full pressure. The pressure feed pipe (6) with inlet junction box (7) is conveniently situated at the head of the ram cylinders. The design of the press is otherwise orthodox, the table (2) being bushed (8) and fully guided on the steel columns (9). The platens (10), (11) and (12) are either electrically or steam heated and any number of these can be employed to form a multi-daylight unit. The floating platen (11) in this case is fully guided on the rods (13) and adjusted by the collars (14).

The press can be made either for upstroke or downstroke operation and is fitted with guards. Pressure feed is from an existing hydraulic mains or if this is not available pumping equipment is supplied, complete with control gear. In the latter case a Frazer two-stage pump is fitted as standard equipment.

We have been given to understand by the manufacturers, Messrs. Hodson and Co. (Machinery), Ltd., Spring Mills, Nottington, near Bury, Lancs, that owing to these methods of production deliveries for standard-size presses are, in some cases, a matter of weeks.

Injection Moulding of Elastomeric Vinyl Materials

By FRANK A. MARTIN*

This paper, reprinted by permission of the Society of Plastic Engineers, Athens, Ohio, from the S.P.E. Journal, February, 1953, was awarded third prize in the S.P.E.'s 1952 prize paper contest. The author deals with the advantages obtainable from mouldings in flexible vinyl materials and discusses the technical difficulties in producing perfect mouldings. To overcome the greatest difficulty, i.e., complete plasticization without overheating to cause degradation, a screw-type pre-plasticizer is recommended.

SINCE World War II there has been a marked interest in the moulding of elastomeric or plasticized vinyl chloride polymers and vinyl chloride copolymer materials, for applications as replacements for rubber. This interest is not surprising since these vinyl elastomers have a number of properties which make them superior to rubber for a wide variety of products. It is not the purpose of this paper to discuss the properties of these materials in detail, but a brief description of the outstanding properties is in order. Since these compounds are thermoplastic and do not require a "curing" period, moulding cycles require only a fraction of the time required for rubber curing. Thus, they offer lower manufacturing costs. Also, since the moulding is generally by the injection process in which the material enters a closed mould there is usually little or no flash-trimming operation required, a further manufacturing economy.

The physical properties of the elastomers are in many ways superior to rubber. Polyvinyl chloride is inert to the deteriorating effects of oxygen, and thus does not suffer the same ageing effects as rubber, such as decrease in tensile strength and elongation with the attendant surface cracking. The vinyl compounds are, with certain exceptions, more resistant to chemicals and solvents. They can be plasticized to give much the same range of hardness as rubber, and a wide range of brilliant, stable colours is available. They can be moulded with a high surface gloss finish not obtainable with rubber. The inherent toughness of the material makes this finish more resistant to scuffing and marring than a rubber compound of comparable hardness. The vinyl materials have good abrasion resistance, low water absorption, and are self-extinguishing. They are non-toxic, and may be compounded to be odourless and tasteless. By suitable selection of compounding ingredients excellent electrical properties may be obtained.

In contrast, the vinyl elastomers also have certain less desirable properties. One of the foremost of these is their temperature limitations. Because of their thermoplastic nature, the plasticized vinyls soften at elevated temperatures. A maximum operating temperature of 140° F. is usually recommended. However, some applications at temperatures of 170° F. have been made, and moulded parts will not "unmould" at 200° F. although they become much softer. There are also low-temperature limitations. With decreasing temperatures vinyls become progressively stiffer and less flexible, and they become brittle at temperatures higher than does rubber. Selection of suitable plasticizers will lower the brittle point, but no plasticizers are available which will allow p.v.c. to compete with rubber for extreme low-temperature applications.

Another possible limitation to the use of soft vinyls is the loss of plasticizer by volatilization, or migration of plasticizers into adjacent plastic or painted surfaces. By careful selection of plasticizers these objections may be considered negligible for the majority of applications. Since p.v.c. is a saturated linear polymer incapable of the cross-linking afforded by the sulphur vulcanization reaction of rubber, the vinyl compounds do not exhibit resilience and elasticity to the same degree as does rubber. They are, therefore, in general not suitable for dynamic applications where elasticity is a requisite factor.

While the vinyl resins are not soluble in the aliphatic hydrocarbons, care must be exercised in the compounding since the hydrocarbons may extract the plasticizers and stiffen the compound. Vinyls are inert to dilute acids, alkalis, and alcohols, but are soluble in ketones, chlorinated hydrocarbons, esters, and ethers.

The favourable properties of vinyl elastomers are being utilized in a multiplicity of moulded applications. Many of these are the result of superior colour and finish. Others are the result of manufacturing economies, and still others take advantage of the abrasion resistance, toughness, and good ageing. It is, therefore, natural that there is a growing interest in the injection moulding of soft vinyls.

The Economics of Moulded Vinyls

Elastomeric vinyl materials on a volume basis are considerably more expensive than the average grade of compound for moulded rubber articles. However, injection moulding cycles of 30 to 90 seconds are only a small fraction of the usual rubber curing cycles of 10 to 30 minutes. It has been shown that vinyl moulded parts up to approximately 3 or 4 oz. in weight can be moulded at a lower cost than a comparable rubber part. When a part weighs more than a quarter of a pound, the higher material cost of vinyls starts to overbalance the production economies, and the rubber part will generally be less costly.

Moulding Methods and Associated Problems

Elastomeric vinyl plastic articles may be moulded by any one of three methods: compression moulding or injection moulding of dry powders or granules, and slush moulding of plastisols. Compression moulding is of only limited application. Due to the thermoplastic nature of the materials, the moulds must be cooled while under pressure, with the result that moulding cycles are very long and costs are high. Compression moulding does have two advantages. Excellent surface finishes can be obtained readily and the exposure to heat is relatively brief so that the danger of heat degradation is small.

Slush moulding of plastisols is outside the scope of this discussion, but it should be mentioned briefly. The process is economically sound and produces parts that are of excellent quality. Several companies have built automatic machines for slush moulding. This process is becoming an ever-increasingly important factor in the vinyl moulding picture.

Naturally, the logical approach to moulding these vinyl elastomers is by means of injection machines. The injection process is inherently a rapid one so that labour costs are low. By injecting the material into the closed die, there is no flash or overflow to trim. The rapid mould turnover permits large quantity production with relatively few cavities. However, the practical aspects of injection moulding of soft vinyls are far from simple. Probably the primary cause of trouble in injection moulding lies in the poor heat stability of the vinyl resins. This factor, together with the low thermal conductivity of the vinyl compounds, accounts for the moulder's chief diffi-

*The Hoover Company, U.S.A.

culty—**inability to achieve complete, uniform plasticization in the heating cylinder before thermal degradation sets in.** This non-uniform plasticization results in moulded parts which may contain in the same piece overheated, underplasticized, and well-plasticized material. The properly plasticized material gives an excellent reproduction of the mould finish. Overheated material shows up as small teardrop patterns, commonly referred to as " splash " marks. This condition is similar in appearance to the mica marks commonly obtained when moulding damp cellulosics. Underplasticized material shows up as dull spots, pronounced flow lines, and weak welds.

It may, therefore, be concluded that the solution to doing a good injection moulding job with soft vinyls lies in getting complete and uniform plasticization of the compound without subjecting the material to sufficient heat to cause thermal decomposition.

Thermal Stability and Conductivity

Before considering methods of achieving this highly desirable degree of plasticization, it is first necessary to understand the problems imposed by the poor thermal stability and conductivity of the vinyl materials. Stabilizers such as lead, tin and cadmium compounds are incorporated in all vinyl compounds, and they do improve the heat stability to a very marked degree. In spite of this improvement, there are no compounds yet available which will satisfactorily withstand the times and temperatures to which they may be exposed in an injection machine heating cylinder. Cylinder temperatures range from 330° to 380° F. or even higher, with 360° F. a commonly used temperature. Even though the torpedoes or spreaders in the cylinders have been streamlined as much as possible to eliminate obstructions where material may lodge and remain motionless for long periods of time, the streamlining is far from 100% effective. Therefore in spite of all precautions, it is impossible to keep some of the material from staying in the heating zone until thermal degradation sets in. The initial effect of exposure of p.v.c. to excessive heating is change in colour. The normally water-white resin passes through a pale straw colour, to a reddish brown, to black on progressive heating. Once decomposition starts, the products of decomposition appear to accelerate the degradation reaction.

One of the end products is a carbonaceous mass. This forms first on the liner of the cylinder and acts as a thermal insulator. It then becomes necessary to increase the cylinder temperature to get enough heat through this carbonaceous barrier to plasticize the material in the inner layers. The higher heat encourages the formation of more carbon, which means that still higher heats are required to penetrate the barrier layer. There is no end to the decomposition cycle. When the decomposed material in the cylinder reaches a certain stage, it begins to break loose and come through into the product. At this point, it becomes necessary to dismantle the cylinder, clean out the burned material mechanically, and start over again. It has been a common experience that cylinders can be run from one to two weeks on the average between cleanings.

The necessity of never allowing vinyl materials to overheat in an injection machine heater cannot be overemphasized. Precautions must be observed in starting a job to see that an occasional purging shot is taken as the material comes up to heat. Even more important is purging at the end of a shift or run. The heat should be shut off and moulding continued as long as the material will flow. Then the mould should be pulled from the nozzle and further purging continued until the material temperature drops below 250° F.

Fig. 1 shows a 50 shore natural unfilled vinyl moulding compound which was removed from an injection cylinder after burned material started to come through into the moulded parts. Note the areas of burned material around the supporting fins of the spreader, and at the bottom where the material feeds into the nozzle. At these points the streamlined flow is obviously imperfect. In the centre portion there are also burned areas. Many times the material is in a much further advanced state of decomposition when a cylinder is dismantled than is shown by this illustration.

Other products of thermal decomposition of polyvinyl chloride are hydrogen chloride and water. The hydrochloric acid so formed will attack chrome-plated cylinders. It may become necessary after extensive moulding of vinyl compounds to refinish and replate the cylinders.

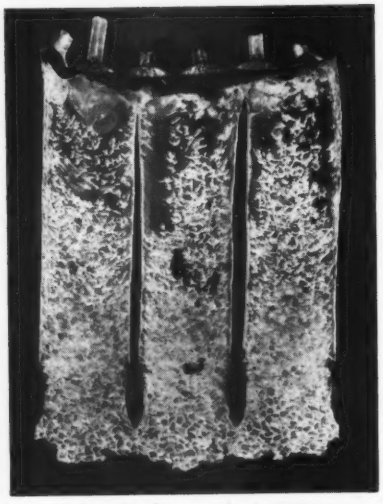


Fig. 1.—Unfilled vinyl compound removed from spreader. Note burned areas.

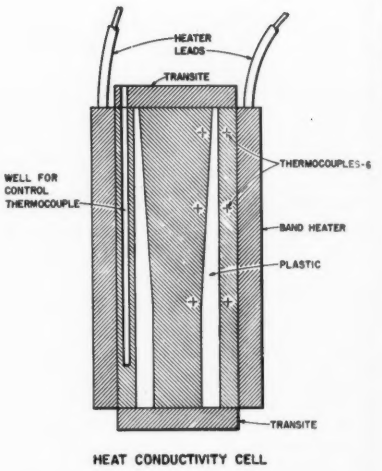
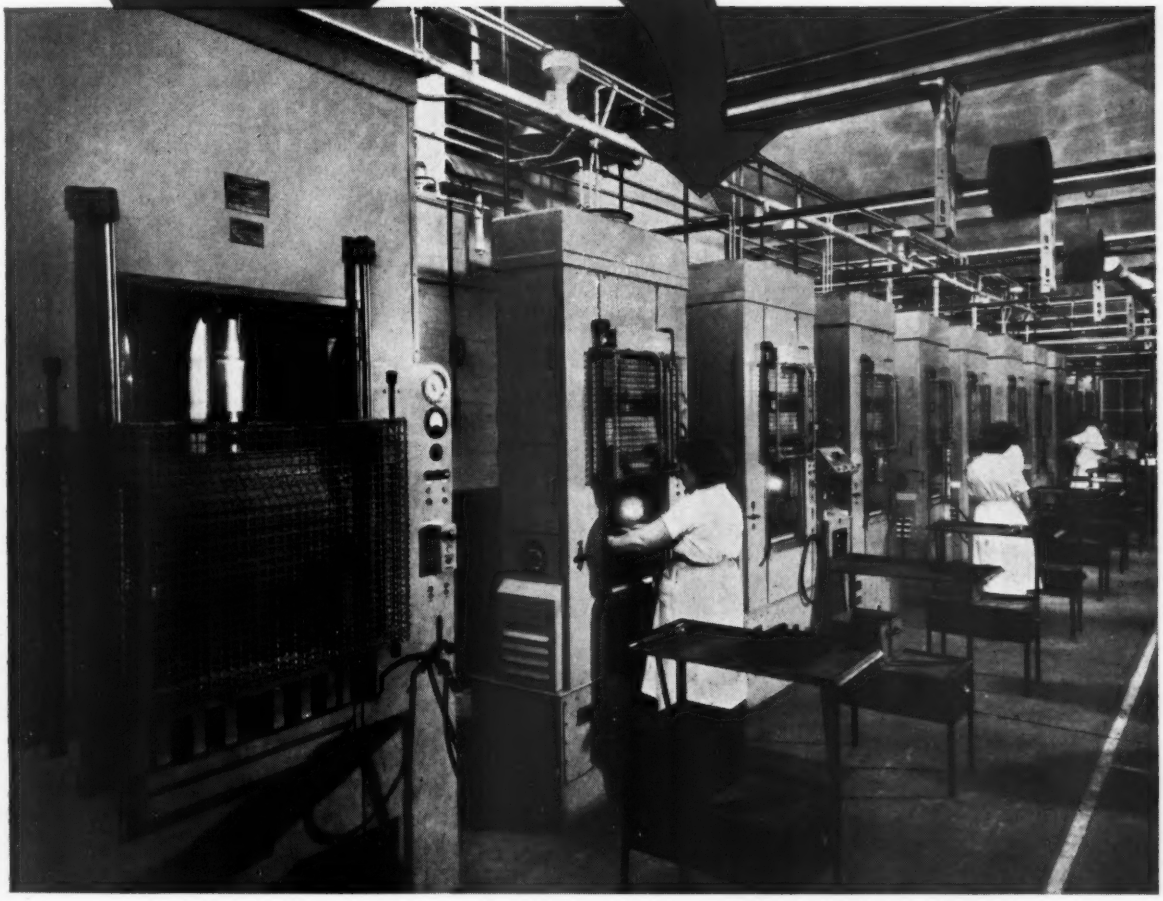


Fig. 2.—Apparatus for measuring thermal conductivity of plastic material.

The problem of plasticizing vinyl elastomers by heat is aggravated by the poor thermal conductivity of these materials. Measurements were made of the relative thermal conductivities of typical vinyl, styrene and cellulose acetate moulding compounds in two different ways. In the one case the conductivity of a solid block 2 in. x 2 in. x 1 in. was measured. Realizing that the conductivity of a solid mass would differ from that of loosely packed granules, a set-up was made whereby the conductivity could be measured at various percentages of packing. Fig. 2 illustrates a miniature replica of a heating cylinder. Thermocouples attached to a recording potentiometer served to measure the temperatures at six points simultaneously so that the progress of heat transfer through the material could be followed. With this equipment the effect of packing could be investigated.

Measurements of conductivity on the solid blocks rated the three materials in the following relative order: cellulose acetate, 1.00; elastomeric vinyl, 0.89; and polystyrene, 0.79. The conductivity as determined by means of the miniature heating cylinder is shown in Fig. 3 for 54% packing and in Fig. 4 for 84% packing. In each case the cellulose acetate exhibited the highest heat transfer rate. At 54% packing the p.v.c. showed the lowest conductivity as evidenced by the fact that for the inner thermocouple to reach a temperature increase of 200° F. required 68 minutes for cellulose acetate, 76 minutes for polystyrene, and 96 minutes for p.v.c. In other words, the p.v.c. required 40% longer time to attain

Some presses! Some layout!



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Modern in conception. BIPEL presses provide for the first time three moulding pressures for each type of press. Three types between them provide nine pressures ranging from 20-300 tons.

Modern in performance. BIPEL auto-control of the moulding cycle can reproduce 'breathing,' 'dwelling,' and any conceivable moulding cycle. Automatic press-button operation leaves no room for human error, ensures the production of mouldings of standard excellence.

Modern in appearance. BIPEL presses with their clean lines contribute to a neat moulding-shop layout. Whether line-fed or with self-contained drive unit, unsightly pipes are eliminated, air temperature is reduced and working conditions are improved.

The photograph shows part of the installation of BIPEL presses at the Colne, Lancs. works of The British Thomson-Houston Co. Ltd. Here are shown one Type 100 and eight Type 40 presses; each has a self-contained drive unit, chosen to allow maximum flexibility of layout.

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This pack for "Easicut" twist drills was produced for English Steel Corporation Ltd., Openshaw, Manchester. The assembly is made up of three separate mouldings: the drill holder, the base and cover. The holder and base are compression moulded in phenolic material. The transparent cover is injection moulded in clear Polystyrene. A phenolic cement is used to assemble the drill holder and base.

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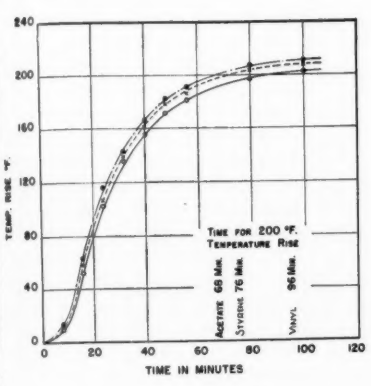
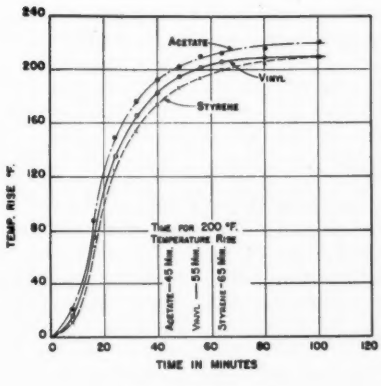


HEAT CONDUCTIVITY DATA
VOLUME PACKING 54.5%

RELATIVE CONDUCTIVITY	
CELLULOSE ACETATE	1.00
POLYVINYL CHLORIDE	0.71
POLYSTYRENE	0.89



HEAT CONDUCTIVITY DATA
VOLUME PACKING 84 %

RELATIVE CONDUCTIVITY	
CELLULOSE ACETATE	1.00
POLYVINYL CHLORIDE	0.82
POLYSTYRENE	0.69

Figs. 3 and 4.—Results of conductivity measurements.

a temperature rise of 200° F. than did cellulose acetate. At 84% packing the cellulose acetate again showed the best thermal conductivity, reaching a 200° F. rise in 45 minutes, but the order of the polystyrene and p.v.c. was reversed. The styrene required 65 minutes and the vinyl compound 55 minutes. These results rate the thermal conductivity in the same order as did the measurements on solid blocks.

Just which set of data is applicable to injection moulding operations cannot be determined. Certainly the granules are loosely packed at the feed end of the cylinder, and just as certainly they have lost their identity at the nozzle end and are in a solid mass. There is undoubtedly a gradual increase in packing from the feed end to some point in the centre where 100% packing is reached. In any event these experiments show that elastomeric p.v.c. compounds are not, generally speaking, as good thermal conductors as are some of the other thermoplastic moulding materials. Therefore, it is to be expected that the plasticizing rate will be slower. The combination of low heat conductivity and poor thermal stability thus constitutes a formidable barrier in the process of injection moulding.

The writer has seen discrete granules of material in the sprues of the same shots which filled the mould cavities with apparently good parts. Certainly that indicates the difficulty of getting good plasticizing action. Increasing cylinder temperatures in these cases only resulted in burning before good plasticization was obtained.

Some Solutions to the Problem

There are two possible ways to attack the problem of getting better plasticizing action. One method is to improve the compounds. That implies increasing the heat stability of the resin or the thermal conductivity of the material. Other angles of attack on the compound may be to develop better flow characteristics either through the use of internal lubricants or by developing new resins with better temperature-viscosity characteristics. That field of endeavour must largely fall to the material manufacturers. It should be a highly rewarding field of research, since the development of elastomeric vinyl compounds which can be moulded without any of the troubles presently encountered should greatly stimulate the interest of moulders and users.

From a moulder's viewpoint, there are a number of things which can be done to obtain better plasticizing action. First of all, the machines may be used from a point beyond the heating cylinder to help plasticize the material. For example, frictional heat may be generated by forcing the material through a small nozzle opening. The use of nozzle opening of 0.080 in. to 0.100 in. in diameter materially assists in the plasticizing action. Nozzles down to .062 in. opening have been used experimentally with very good effects on plasticizing action. However, this opening was too small to pass the flakes of carbon which sooner or later appear, and frequent removal of the nozzle to unplug the hole was required.

Further frictional plasticizing action may be obtained through the use of pin-point gates. The frictional heat generated as the material is forced through very small gates is sufficient in some cases to overheat the material and result in rejects due to splash marks. In such a case, opening the gate slightly will generally relieve this condition. On the other hand, when the gate cross-section is too large, insufficient heat is generated to finish the plasticization, and dull or cold spots appear in the moulded piece. Frequently the only alternative is then to weld the gate shut, and regate starting with a very small gate, gradually opening it until plasticizing action by means of frictional heat induced by pin-point gating is effective in producing good plasticization. It is difficult, however, to establish the optimum gate size, particularly when parts with large surface areas are being moulded. In connection with the pin-point gate, the runners should be of the full round or trapezoidal shape, and of generous size.

The combination of poor thermal stability and low heat conductivity properties of vinyl elastomers make it expedient to derate the injection moulding machines to approximately 40% to 60% of the rated capacity. By designing moulds to take substantially under the rated machine capacity the material takes longer to go through the heating cylinder so that in spite of its low thermal conductivity fairly good plasticizing action is obtained. Derating also by holding the material in the cylinder longer permits the use of somewhat lower temperatures in the cylinder, which definitely retards thermal degradation.

Another common problem encountered in injection moulding of plasticized vinyl materials is "back-rinding." This is a condition in which excessive shrinkage takes place at the gate and the part shrinks or pulls back into itself. This condition is not attributable to the plasticizing problem previously discussed, but is probably caused by the excess shrinkage of the hot material. There are several procedures which may cure "back-rinding." One is by proper control of the time the injection plunger is held forward. Another is by the use of relatively wide, flat gates. Neither method can be guaranteed for any particular job.

The estimation of material shrinkage for the purpose of establishing mould dimensions also imposes a problem. Shrinkage varies with the amount and type of plasticizer used in the compound. In general, it will run from 1.5% to 2.5%. However, shrinkage of a given compound may also vary considerably when used in different moulds. The only sure way to establish shrinkage is to make an experimental mould cavity and actually determine the shrinkage. Fortunately, the majority of applications for vinyl elastomers do not require very exacting control of finished dimensions, since these materials are used because they do possess the property of elasticity.

Still another problem in moulding plasticized vinyls is one which is connected with that of plasticizing in the moulding machine. There is a big difference between different shipments of the same compound as to how easily the material may be heat plasticized. These

differences mean that the moulder must adjust his moulding conditions to suit a particular batch. Changes in temperatures and cycles are required in order to achieve satisfactory moulding. Changes in moulding cycles for a given job have been observed to run from 25% to 105%. While part of the blame for changing moulding conditions may properly be attributed to changes in the plasticizing capacity of the cylinder due to carbonization, certainly there is a large variability in moulding compound shipments.

Pre-plasticizing—Screw-type Machine

There is another approach to the problem of plasticizing elastomeric vinyl compounds for injection moulding. It is a matter of common knowledge that these materials can be thoroughly plasticized in a screw-type extruder. In that type of machine, the plasticizing action comes from two sources, externally applied heat and frictional heat generated in the material by the mechanical working of the material. In fact, it is necessary in most cases when extruding vinyl elastomers to provide means of removing the excess frictional heat. The gloss and surface finish of extruded goods are ample proof of the fact that the screw machine does a very good plasticizing job. The extruder has the further advantage in that the screw moves all of the material forward and out of the hot barrel, so that there is little opportunity for a material to lodge and decompose. Therefore, a combination of a screw-type plasticizing machine with an injection moulding unit should be ideal for moulding vinyls.

Such a machine employing the Hendry screw pre-plasticizing principle has been on the market for several years. One of these machines has been running for over a year, moulding vinyl distributor cap nipples. On this job the cycle was shorter than a conventional machine, and the gloss and surface were better. Figs. 5 and 6 show a general view and a view of the plasticizing section of this type of machine.

Pre-plasticizing by means of an extruder offers a great many advantages. First of all, the screw does a much better plasticizing job than can be obtained by pushing material through a heated cylinder containing a spreader. There is ample experimental evidence to confirm this fact. The thoroughly plasticized material produces moulded parts with better surface finish and gloss, and free from cold spots and splash marks.

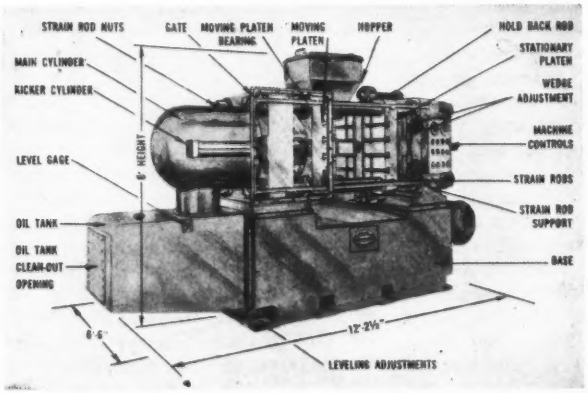
The screw pre-plasticizing machine can be operated at much lower temperatures than conventional machines. Typical vinyl parts can be moulded at 250° F. extrusion chamber and injection chamber wall temperatures. Frictional heat does bring the material temperature up to approximately 320° F., at which point it is in an ideal state to mould. Since the metal walls with which the material comes in contact are well below the temperature at which decomposition is appreciable, the danger of burning material is practically eliminated. Also, the self-cleaning design of the screw and better streamlining of the injection chamber through the elimination of the spreader preclude the possibility of material remaining in contact with the hot metal walls long enough to burn.

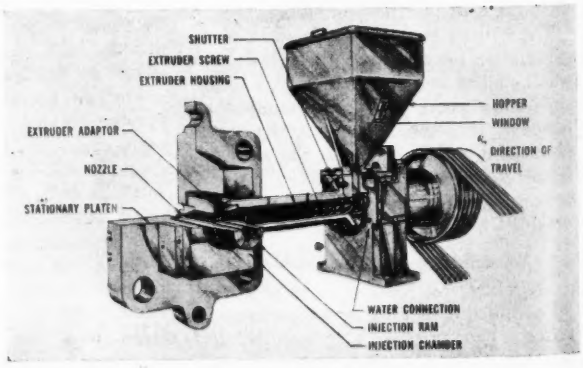
One of the big advantages of the screw-type, pre-plasticizing machines lies in its increased plasticizing capacity. It has usually been found that the moulding time is established by the time required to plasticize sufficient material for the mould charge rather than by cooling time in the mould.

By way of example, in running a 9 oz. shot on a conventional 12 oz. injection machine, the overall moulding cycle was 135 sec. on the average. The parts were sufficiently cold to be removed from the mould in 30 sec., yet the cycle could not be reduced because after a few shots the material was too cold to mould. Nor could the temperature be increased to compensate for shorter cycles without starting to get thermal decomposition. Under these particular conditions the plasticizing rate of this 12 oz. machine was calculated to be only 18 lb. of vinyl material per hour. In contrast, the plasticizing rate of one of the 16 oz., screw-type, pre-plasticizing machines with a 2½-in. screw on the same material was found to be 60 lb. per hour, an increase of 233% for an increase of only 33% in rated machine capacity. Without a doubt, further increases in plasticizing capacity can be obtained under optimum conditions, since similar material is often extruded from a 2½-in. extruder at a rate of more than 100 lb. per hour. Therefore, the overall moulding cycles can be greatly shortened.

The screw pre-plasticizing unit has a further advantage over conventional machines for moulding soft vinyls. The screw is designed to give the maximum compounding action. Therefore, it is unnecessary to use compounded material for moulding. By definition, compounded material here refers to granules of compound produced by fluxing the resin, plasticizer, stabilizer, colour, etc., either in a heated Banbury-type mixer or on a two-roll mill; sheeting, then dicing or granulating. In contrast to this compounded or granular material, the screw-type machine will mould material prepared by mixing all the ingredients in a ribbon-type mixer until a dry, free-flowing powder results. Sufficient heat is supplied to the jacket of the blender to cause the resin particles to absorb the plasticizer so that the resultant powder is similar in appearance and feel to granulated sugar. The ability of the screw-type machine to mould pre-blends results in a number of advantages. First of these is a large reduction in material costs. Banburying, milling and granulating operations are all eliminated. Savings in material cost have been estimated at from 8 cents to 11 cents per lb. in favour of the pre-blend manufactured in the moulder's plant over the same granular formulation purchased from materials suppliers. In addition, the pre-blend, having a much

(*Continued on page 260*)





(Left) General view of screw-type pre-plasticizing injection moulding machine; (right) screw pre-plasticizing unit.

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2s. 8d. each (including postage).

B.P. 686,023. Acrylonitrile copolymers, compositions thereof and method of preparing shaped articles therefrom. G. F. d'Alelio, T. G. Finzel. To: Industrial Rayon Corp.

B.P. 686,031. Manufacture of metallized polytetrafluorethylene and product thereof. F. J. P. J. Burger, R. West, Tzu En Shen. To: British Dielectric Research, Ltd.

Copper applied by evaporation in a vacuum gives an adherent deposit. A secondary layer of metal or plastic may be applied, the copper acting as bond.

B.P. 686,044. Shuttlecock construction. W. C. Carlton.

B.P. 686,059. Method of manufacturing plastic shuttlecocks. W. C. Carlton.

B.P. 686,078. Packing of articles or substances. To: Lever Brothers and Unilever, Ltd. (Netherlands).

The packing of granular, liquid, plastic substances in sealed tubes of Pliofilm, Cellophane, plastic-covered aluminium foil, etc.

B.P. 686,114. Varnish with superpolyamide basis, for enamelling. To: British Thomson-Houston Co., Ltd. (France).

B.P. 686,118. Manufacture of small, shielded electrical components. L. A. Fountain, D. Phillips. To: Belling and Lee, Ltd.

After making small holes in all parts of the metallic casing, the complete casing is assembled with the components inserted therein in a mould. Molten insulating material (polythene) is then injected into the mould to form an insulating shell.

B.P. 686,142. Thermoplastic compositions. To: Celanese Corp. (U.S.A.).

The composition comprises a cellulose ester of an organic acid (cellulose acetate or propionate) plasticized with a mixture of triphenyl phosphate and tripropyl phosphate. Products of high-impact strength, good moisture resistance, heat stability, fire resistance and less corrosive tendencies are obtained.

B.P. 686,171. Moulds and moulding. J. E. Gordon, C. G. Evans. To: Nat. Research Development Corp.

The mould for synthetic resins serves for moulding, e.g., metal inserts integrally with the finished article. A lining is moulded about a pattern of the article, this lining clothed with a parting agent and the mould body moulded about the lining and jig members (pins to accommodate an insert), which are fitted to the lining.

B.P. 686,232. Manufacture of vinylic polymers and copolymers. To: S. A. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny and Cirey (France).

The " induction " period for vinyl chloride may be considerably shortened if the monomer is treated with activated carbon before polymerization.

B.P. 686,242. Bonding a non-metallic frangible element to another non-metallic element. To: Willys-Overland Motors Inc. (U.S.A.).

A panel of glass is bonded to a plastic part (knob or block) of melamine formaldehyde by phenol and buna-N resins.

B.P. 686,258. Films. To: Celanese Corp. of America (U.S.A.).

B.P. 686,265. Films. To: Celanese Corp. of America (U.S.A.).

B.P. 686,267. Presses and moulds used therein. Pulp Industries, Ltd., D. C. Davy.

Opposite side walls of the mould are mounted on cranks so that they move in parallel in arcuate paths. In closed position, the cranks are at dead centre so as to take the thrust during moulding.

B.P. 686,288. Method of bonding non-metallic elements together. To: Willys-Overland Motors Inc. (U.S.A.).

Resinous plastic material is bonded to glass (weather stripping) by a combination of phenolic resin and buna-N resins (or other bonding material) through fusing by high-frequency current.

B.P. 686,291. Method and apparatus for the production of hollow articles from thermoplastic material and articles produced thereby. To: Novoplast G.m.b.H. (Switzerland).

Bottles are made in two stages. First a blank is obtained with a comparatively thick wall in a first-injection mould. Then the blank is subjected to fluid pressure in a second mould with a plurality of sections and expanded to final shape.

B.P. 686,293. Self-sealing condensers. To: Robert Bosch G.m.b.H. (Germany).

Non-metallized dielectric strips are made of polystyrene.

B.P. 686,306. Illuminated signs. D. Currie, J. F. Summersgill.

B.P. 686,310. Production of cellular materials. To: S. A. l'Equipment Ménager et Industriel " E.M.I." (France).

The mechanical resistance of a gas-expanded cellular body is increased after formation of the body by converting part of the plasticizing agent into a compound of lesser plasticizing power. This conversion is effected preferably by chemical reactions, polymerizations or copolymerizations.

B.P. 686,337. Treatment of polystyrene for use in electroscopes. R. A. Stephen.

The polystyrene insulation prior to calibration is subjected to a certain penetrating radiation.

B.P. 686,348. Electric insulator. D. Nield.

It is moulded from polythene, polyvinyl chloride or like plastics flexible when sufficiently thin.

B.P. 686,374. Process and apparatus for manufacturing thermoplastic sheet material. To: Congoleum-Nairn Inc. (U.S.A.).

Jasperized and marbleized floor and wall coverings are made from vinyl resins pigmented and treated under controlled conditions.

B.P. 686,385. Production of decoratively coated sheets, boards and the like. W. Berry, C. R. Oswin. To: British Cellophane, Ltd.

B.P. 686,398. Lining of hollow articles. J. O. Blaksley. To: I.C.I., Ltd.

The lining is of polythene applied as an inflated tube by heating to softening point.

B.P. 686,403. Shuttlecock and method of making. Carlton Tyre Saving Co., Ltd., W. C. Carlton.

B.P. 686,416. Hair brushes for personal use. C. E. Maynard. To: Pro-Phy-Lac-Tic Brush Co.

An all-synthetic plastic brush (methylmethacrylate, vinyl resins incl. polystyrenes, cellulose acetate) with each bristle independently sealed in a moulded back and spaced from every other bristle.

B.P. 686,423. Riddled thermoplastic material and method of producing the same. To: Union Carbide and Carbon Corp. (U.S.A.).

A thermoplastic resin sheet not thicker than 0.02 in. is heated and pressed between a smooth backing and a woven wire screen of certain dimensions corresponding to the thickness of the sheet to obtain a water-impervious sheet.

B.P. 686,438. Extrusion of tetrafluoroethylene polymer. To: E. I. du Pont de Nemours and Co. (U.S.A.).

Colloidal-sized particles of tetrafluoroethylene polymer are intimately mixed with a certain organic lubricant. The lubricant vaporizes before sintering.

B.P. 686,444. Pencil leads, crayons and like marking substances. A. R. Julien. (France).

At least 50% thermoplastic material (cellulose acetate, polyethylene, polyvinyl chloride) is included.

B.P. 686,445. Plastic compositions. E. I. Cooke. To: Telegraph Construction and Maintenance Co., Ltd.

A loaded plastic material for internal medical uses possessing X-ray-opaque properties comprises nylon, polyethylene, polyvinyl chloride, polymethyl methacrylate or polystyrene, containing a water-insoluble bismuth compound.

B.P. 686,446. Process producing heteropolymeric resinous material. W. W. Crouch, R. K. Harris. To: Phillips Petroleum Co. (U.S.A.).

An organic monomer (mono-olefin) and sulphur dioxide is polymerized in aqueous emulsion in the presence of suitable catalysts (lithium nitrate) and emulsifying agents. The resin is obtained in finely divided form.

B.P. 686,466. Developer for electrostatic images. L. E. Walkup. To: Battelle Developments Corp.

In the electrophotographic process, a mixture of electroscopic powder and a granular carrier is used. The powder may be a certain phenol formaldehyde resin (Amberol F-71).

B.P. 686,485. Windows made of profiled metal or profiled plastic material. R. Postrihac. (Germany).

B.P. 686,505. Screens for use with a source or sources of illumination. M. Kilemnik. (France).

The screen is composed of light-diffusing rib plates and wall elements moulded, e.g., from polystyrene.

B.P. 686,537. Method of producing artificial resins. To: Houillères du Bassin du Nord et du Pas-De-Calais. (France).

Pale, hard, high-melting resins can be obtained by treating a benzol fraction in which styrene, indene, coumarone are present together with a mixture of boron trifluoride hydrofluoric acid and fluorboric acid. The method is also applicable to styrene, indene and coumarone containing lower-boiling fractions obtained by low-temperature carbonization of mineral coal.

B.P. 686,557. Pourers for discharging pulverulent material from a carton, box or like container. M. D. Salisbury.

B.P. 686,579. Extraction process for polymer treatment. To: Koppers Co. Inc. (U.S.A.).

Low molecular-weight components may be removed from polymer particles (beads, powder, granules) by an extractant which is a solvent for the components but a non-solvent for the polymer. During extraction, a suspension agent prevents agglomeration and lumping of the polymer particles. An example shows the application to polystyrene improving its shrink resistance and other properties.

B.P. 686,595. Heat-curing adherent resins and resin-films. C. K. Heasly. To: Minnesota Mining and Mfg. Co. (U.S.A.).

A stable blend of a polyvinyl acetal with a normally unstable mixture of a phenol-aldehyde resin and an aldehyde in a volatile solvent (in thin film form) is cured at 125-180 degrees C. to an effective electrical insulator.

B.P. 686,616. Production of expanded films and tubing. To: Milprint Inc. (U.S.A.)

The apparatus is advantageously applicable in the continuous production of transversely tensilized or expanded tubing of rubber hydrochloride (for encasing food products), but may also be utilized for other thermoplastic materials.

B.P. 686,625. Method of making plastic tubes and films. C. R. Irons. To: Dow Chemical Co.

Accurate control of diameter and wall thickness is obtained by imposition of a controlled and small amount of pneumatic pressure in that portion of the hot plastic vinylidene chloride polymer tube which passes between the extrusion orifice and the upper levels of the supercooling bath.

B.P. 686,635. Compressed sponges and method of making the same. C. L. Wilson (U.S.A.).

A polyvinyl formal sponge is prepared from polyvinyl alcohol having 35-80% of the hydroxyl groups reacted and is compressed under at least 100 lb./sq. in. to 1/10 its original thickness.

B.P. 686,639. Stabilization of polyacrylonitrile solutions. To: E. I. du Pont de Nemours and Co. (U.S.A.).

To minimize colour formation, a certain solution of dimethyl formamide is used.

B.P. 686,651. Process and apparatus for continuous milling of plastic material. To: Union Carbide and Carbon Corp. (U.S.A.).

Normally solid plastics (vinyl polymers, rubbers, phenol-aldehyde resins, cellulose plastics, alkyd and polyester resins) are introduced as a viscous adhesive mass between a rotating smooth surface of revolution and a stationary smooth surface (or pair of oppositely rotating mixing rolls) with a convergent zone in a milling clearance.

B.P. 686,671. Method for the production of films and adherent coatings containing nitrocellulose in solution in a solid polymeric resinous material and compositions for their production. S. F. Marrian, A. W. S. Clark, I.C.I., Ltd.

B.P. 686,672. Method for the production of films and adherent coatings comprising nitrocellulose in solution in a solid polymeric resinous material and compositions for their production. S. F. Marrian, I.C.I., Ltd.

B.P. 686,674. Trays. D. M. Dutton.

B.P. 686,682. Collapsible pot or receptacle. S. Craft.

B.P. 686,710. Filaments, films, rods or tubes prepared from polymers of vinylidene cyanide. H. Gilbert. To: B. F. Goodrich Co. (U.S.A.).

When such filaments (films, rods, tubes) are stretched in two or more steps in a hot zone, the randomly-oriented crystals become oriented in a single direction or plane. Their strength increases greatly (to over 60,000 lb./sq. in.) and also other properties (elongations at break less than 20%; excellent flexibility).

B.P. 686,768. Adhesive bonding of polymethylmethacrylate material. B. B. Chemical Co., Ltd., A. D. Woods, A. Hardy.

Perspex or Lucite are bonded to an intermediate layer of rubbery material by cyclized natural rubber. The rubbery material may be bonded, by known means, to, e.g., a metal frame.

B.P. 686,804. Protection armour for electric cables. To: Soc. Industrielle de Liaisons Electricques (France).

The armour is a metallic braid. The component elements are individually coated with a thermoplastic or thermosetting resin (vinyl, cellulose, polyamide, glycerophthallic, phenolplast, aminoplast).

B.P. 686,814. Making gas-expanded organoplastics. To: United States Rubber Co. (U.S.A.).

B.P. 686,827. Thermoplastic moulding compositions. H. Shaw. To: Bitumex, Ltd.

For making pipes or troughs impervious to moisture, cresol formaldehyde resin containing excess of aldehyde is admixed to coal tar pitch and crude tar acid.

INJECTION MOULDING OF VINYL MATERIALS (*Continued from page 258*)

lesser heat history, should be able to withstand more processing or end use heat than granular material. The use of pre-blends will also add flexibility to the moulder's operations in inventory reductions and ready availability of colours.

Additional advantages of the screw-type, pre-plasticizing injection machine are ease in changing colours and reduction in time for cleaning heating cylinders. The size and location of mould gates is also less critical since it is not necessary to depend on the gate for the final plasticizing action.

There are also some disadvantages in connection with using the screw pre-plasticizing type of machine. The machine is more expensive, but not unreasonably so when it is taken into consideration that it is in reality two machines: an injection machine and an extruder. There are temperature control problems arising from the frictional heat generated in the screw, but these can be solved by application of extrusion techniques on similar materials. As with any type of pre-plasticizing machine where the injection plunger pushes on hot, soft material, there is some leakage of material back along the plunger. This leakage can be brought under control if plunger and cylinder liner are constructed from materials which can be run at relatively close clearance without scoring.

Summary

The elastomeric vinyl plastics offer at the same time both a fertile field for new product development and a number of production moulding problems to the custom moulder. These materials have properties which will permit them to replace rubber in many applications, bringing to those applications advantages of better appearance, better ageing and lower costs.

In the present state of development the soft vinyls are difficult to mould in conventional-type injection machines. Most of the difficulties can be traced directly to the poor plasticizing action of the heating cylinder on these materials due to their poor thermal stability and low thermal conductivity. The use of frictional heat generated by forcing the material through small nozzle openings and through pin-point gates assists greatly in getting uniform plasticizing action with the resultant improvement in appearance of the moulded piece.

The screw pre-plastizing type of injection moulding machines presents many advantages as a means of moulding vinyls. Among these advantages are relative freedom from thermal degradation, more uniform plasticization, increased plasticizing capacity, and faster moulding cycles. Material savings can also be obtained by moulding directly from pre-blends, rather than granular materials.

Thanks are due to Mr. R. M. Hershey who obtained much of the experimental data, and to the Hoover Company for permission to publish the information contained in this paper.

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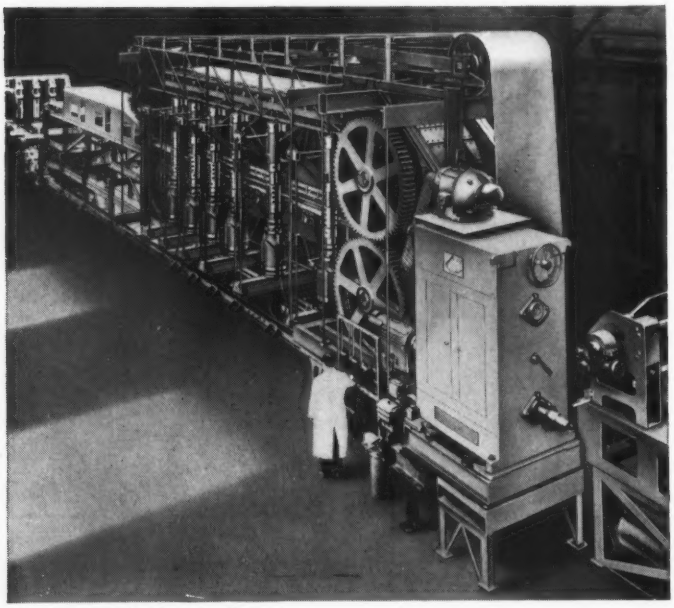

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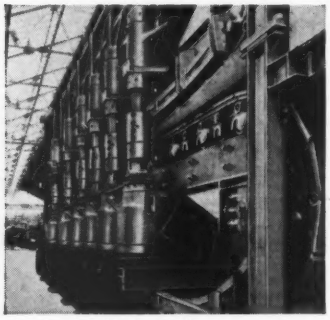
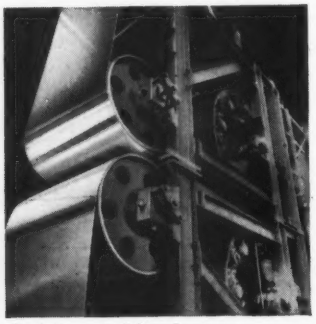


A view of the press from the feeding end



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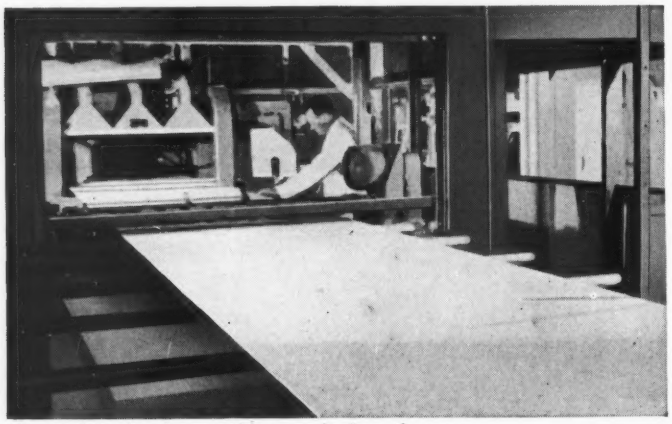

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PATENTS

The Bartrev Process and Automatic Press have been covered by patents and patent applications throughout the world.

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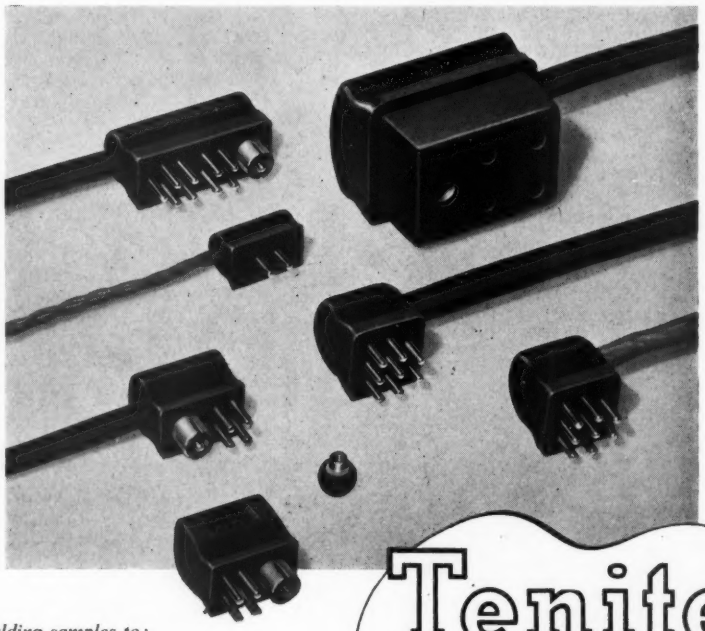

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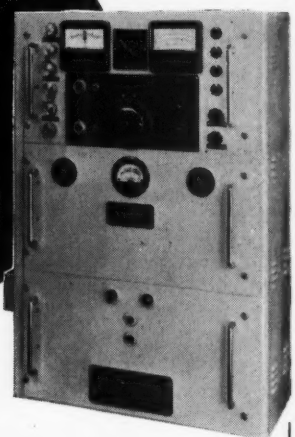

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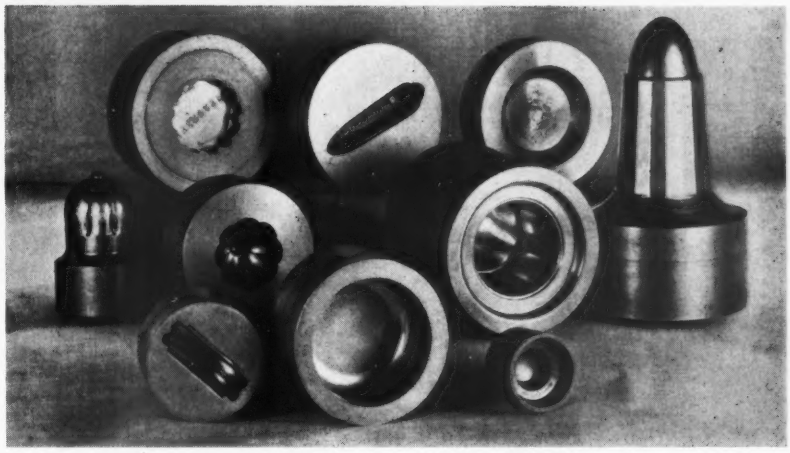

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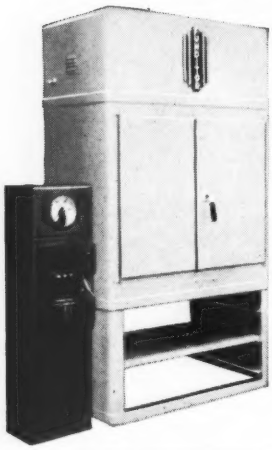

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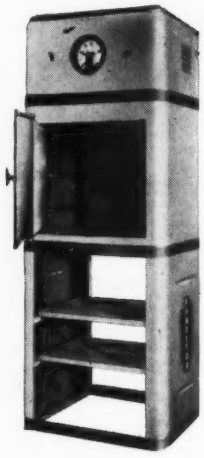

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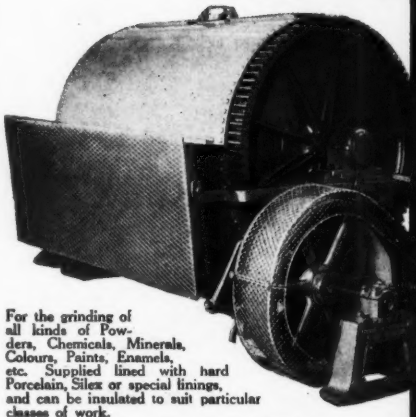

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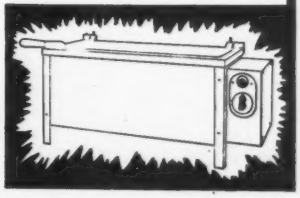

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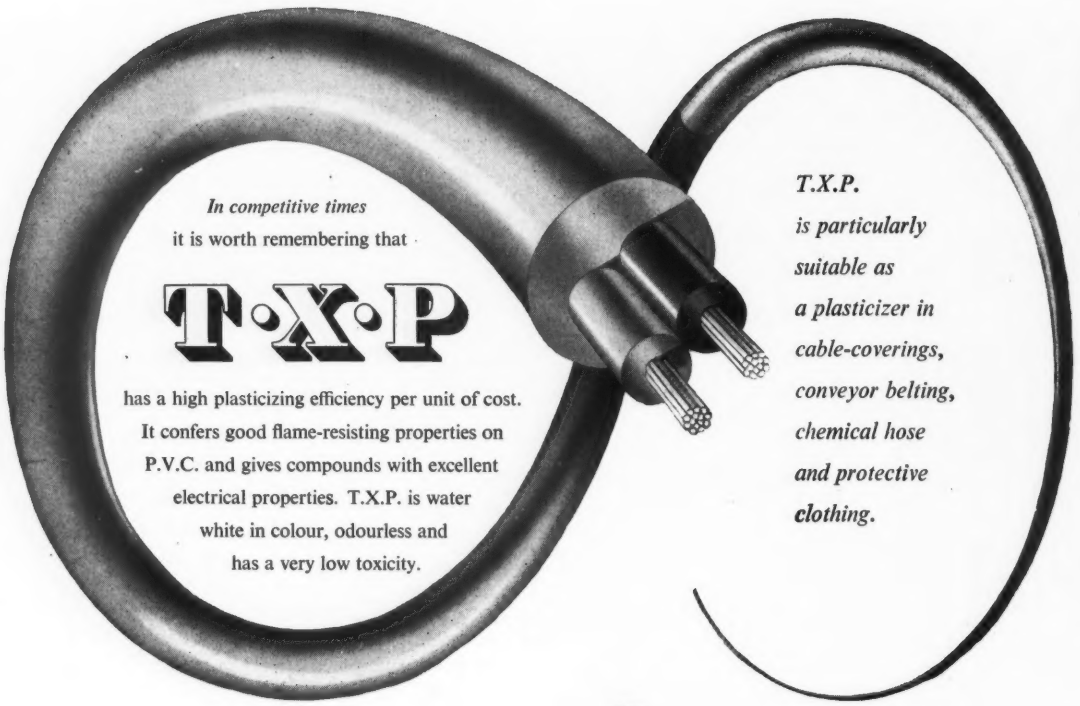

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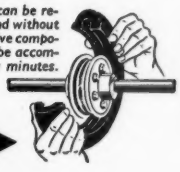

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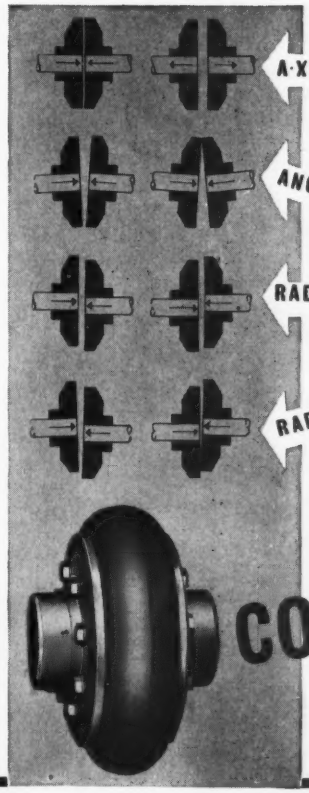

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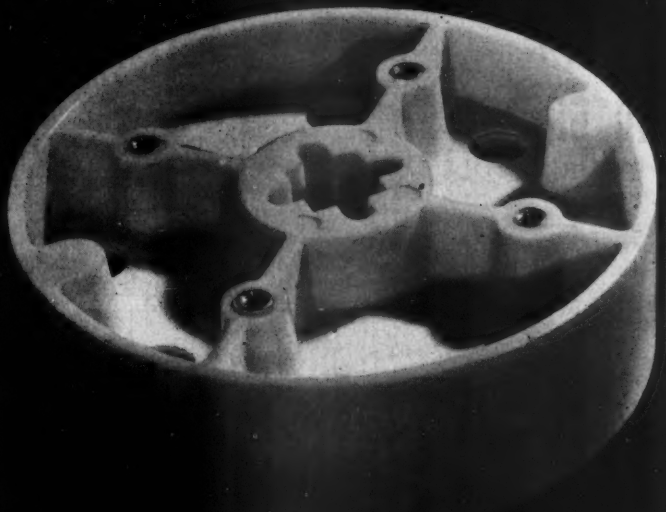

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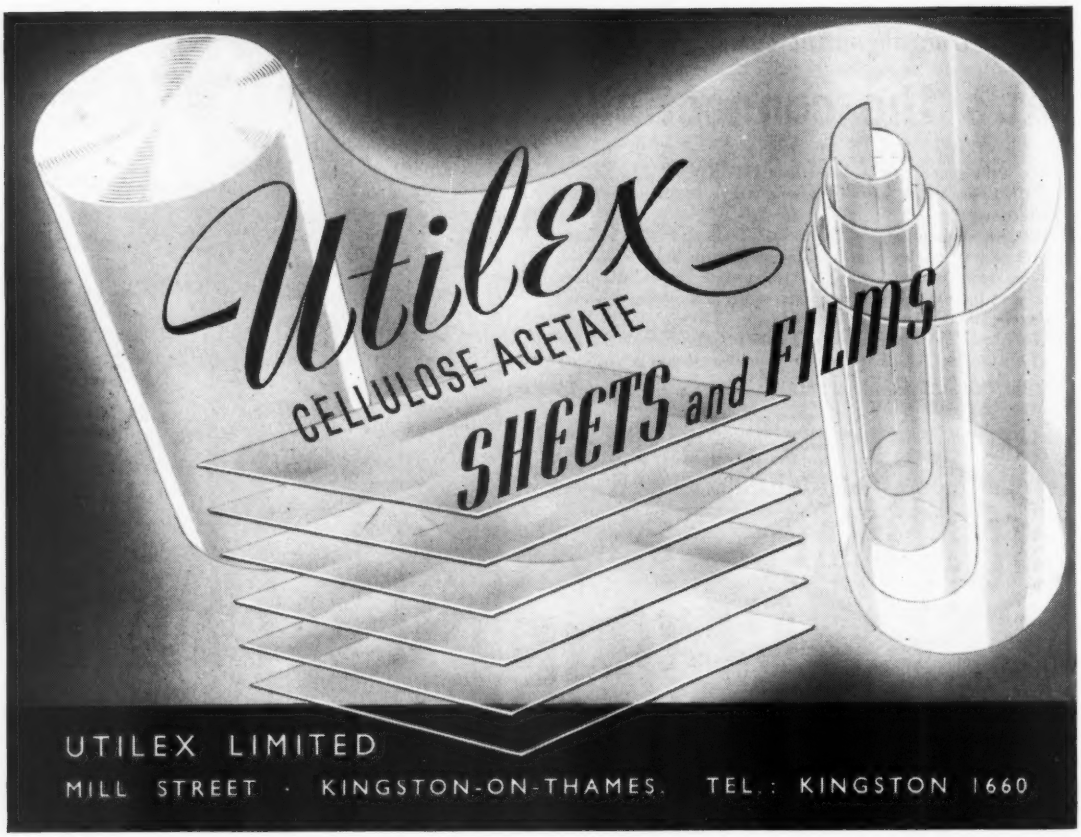

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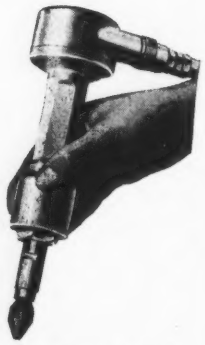

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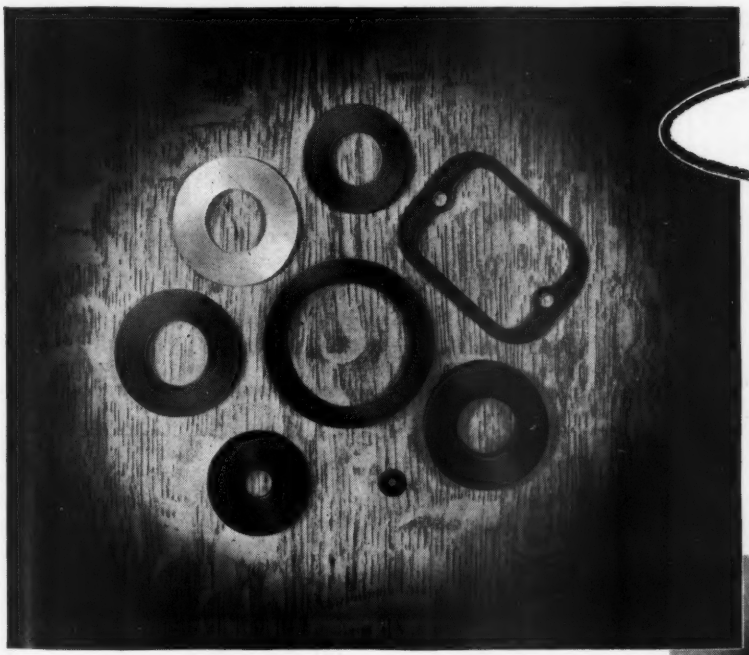

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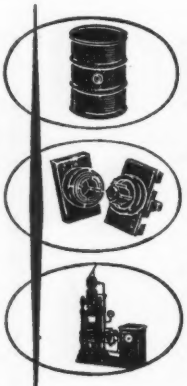

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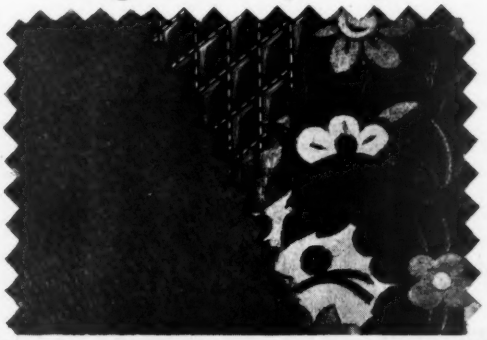

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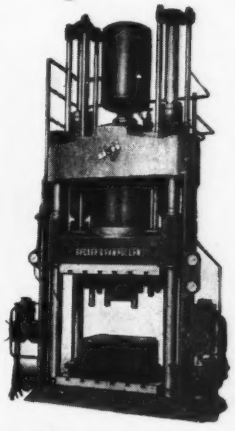

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THE 26th annual general meeting of Imperial Chemical Industries, Ltd., was held on June 18 in London.

Mr. J. Rogers, O.B.E., LL.D., chairman of the Company, in the course of his speech, said:—

Had it not been for the set-back in the textile and other industries, we should have expected 1952 to have shown substantially better results because every year we are bringing new plants into operation. I referred last year to growing competition and to changing trade conditions both at home and overseas. The fact that our turnover as a whole for 1952 was a new record and that exports alone were also a record affords some indication of the extent to which the challenge of new marketing conditions has been met. In 1953 trading conditions so far can best be described as mixed. For some of our products the year is going well and the prospects are good; for others the position is obscure, particularly where entry into overseas markets is restricted because of currency difficulties.

Complex Organizational Problems

Your Directors remain alive to the importance of adapting the Company's operations and organization to meet changing conditions. Perhaps I may be allowed to dwell a little longer on this aspect of our affairs.

Your Company's activities range widely over the chemical field and indeed are not confined to that field, embracing as they do, for example, non-ferrous metals, "Lightning" fasteners, paints, leathercloth, and some semi-fabricated plastic materials. Its products are numbered in thousands and they are supplied to many industries. The organizational problems that confront your Company are therefore much more complex than those experienced by undertakings concerned with the manufacture of one or two main products. Your Company's research and development work is directed towards improving its existing manufacturing processes, developing new processes, developing new uses for its existing products, and to discovering new products and creating markets for them. On this work of research and development we are now spending at the rate of about £7,500,000 a year. Today we are making many products which were unknown before the war, and some of our methods of producing our older and more traditional products are very different and much more efficient than they were before the war. We can expect our new products to contribute an increasing proportion of the Company's profits.

This process of change and development must go on if the Company is to remain vigorous and prosperous, for the chemical industry still has great possibilities for expansion, and, in expanding, it can contribute much to the national economy. Such expansion calls for more, not less, research and development and this work must be well inspired and well led. Not every research results in a new product or a better process, and it may take seven to ten years or even longer to pass from the first research result to commercial production.

Your company manufactures in many overseas countries, in most cases in association with nationals of the countries concerned; and, as our Annual Reports have clearly shown, our export trade is world wide. Its overseas interests are comparable in size and importance with the interests it has in the United Kingdom and are even more complex.

Plants at High Efficiency

Here at home your Company has maintained all its productive plants at a high level of technical efficiency, and we are constantly striving to improve our manufacturing processes. We are in the forefront in the study and application of modern methods of increasing productivity, and we are now giving our knowledge and experience in this field freely to British industry in general.

The steadily improving efficiency of your Company's operations means lower costs of production, and these lower costs are reflected in the selling prices of our products. We have had to advance the selling prices of many of our products in recent years because of increasing costs of raw materials and rising wages and salaries, but we have been able to offset these cost increases to a considerable extent by savings resulting from improved methods and increased efficiency. As a result, our prices are, in general, lower than those ruling in America and in Europe

You will remember that four years ago Lord McGowan told you that the whole Board of I.C.I. took the view that your Company is not an appropriate subject for nationalization. That remains the view of your Board today, in whatever form State ownership is suggested. Lord McGowan also said that the Board would take all proper steps to oppose the nationalization of your Company if the attempt were ever made. Let me renew that assurance. You will, I am sure, agree that it would be contrary not only to the interests of the stockholders and of those employed by your Company but also to the interests of the country as a whole for I.C.I. to come under any form of State ownership.

"Challenge to Britain"

I have just read the Labour Party's pamphlet called "Challenge to Britain". There is nothing in that document to cause me to change my view that any form of State ownership would be extremely detrimental.

The main reason given in the pamphlet for this programme of public ownership is that chemical production must expand to keep pace with the enlarged requirements of other basic industries. Of course chemical production must expand, and this is exactly what has taken place in the Industry as a result of the enterprise shown by those in it. My speech today emphasizes the expansionist policy which I.C.I. has consistently pursued. I.C.I. is meeting every demand for chemical materials made upon it in the United Kingdom, and the average level of prices is lower than that in the U.S.A. and Europe. In addition its exports have increased very substantially in volume and in value since the war and are now running at over £1,000,000 per week. I can say without qualification that no company has a finer record of expansion and enterprise.

Why then should public ownership be suggested as a safeguard against possible shortages, which do not exist, and which will never occur, if Private Enterprise is permitted to go ahead? Surely the experience of the State-owned industries is convincing evidence that whatever else may be said about State ownership it is no guarantee that production will keep pace with increasing demand. I can only hope that those responsible for "Challenge to Britain" will give the whole subject further factual study and that in the long run wiser counsels will prevail.

Terylene

The plant to manufacture "Terylene" at Wilton on a large scale is planned to be in operation by the end of next year. The new articles of "Terylene" clothing which you may occasionally see in certain shops are made from "Terylene" produced at a small pilot plant at Hillhouse. After the most careful assessment of market requirements we are already putting in hand plans for a large extension of the Wilton plant, even though the first unit of that plant is not yet in production. This is a good illustration of the point which I made earlier that an increasing proportion of the Company's productive efforts is being devoted to products which were unknown before the war.

As already publicly announced, we have decided to manufacture "Terylene" in Canada as well. Pending settlement of plans arising out of the Anti-Trust case for the segregation from du Ponts of our interests in Canadian Industries Ltd., we have incorporated a new subsidiary, Imperial Chemical Industries of Canada Ltd., wholly owned by I.C.I., and this new company is going straight ahead with the purchase of land and the erection upon it of a plant to manufacture "Terylene". In this way we are taking time by the forelock and not awaiting the outcome of the protracted legal proceedings in the United States. After the proposed segregation, it is intended to offer this project to that successor company of C.I.L. in which I.C.I. will be the principal shareholder and in which Canadians will participate as shareholders. This procedure is in accordance with I.C.I.'s policy of regarding the successor company as the normal medium for developing manufacturing projects in Canada.

Improvements in methods of producing our existing products and the reduction of costs go hand in hand with the development of new products. Your Directors are also very conscious of the need to keep down the level of overhead expenditure. Special attention is being given to expenditure on central services, which is being kept to a minimum consistent with efficiency and progress.

Chairman's Retirement

I should like to finish on a personal note. This is the last occasion upon which I shall occupy this Chair. As announced to the Press immediately after the Board Meeting on the 15th May, I am retiring both from the Chair and from the Board at the end of this month. I have been a Director of this Company since its formation twenty-seven years ago and my association with Nobels, one of the constituent companies which were merged on the formation of I.C.I., goes back to the beginning of the century. May I take this opportunity of thanking my colleagues for all their help, their kindness and their co-operation during my long association with them and particularly for their support since I took over the Chairmanship from Lord McGowan two and a half years ago. You can be sure my successor, Dr. Fleck, will be given similar support.

The report and accounts were adopted.

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Seven 1,280 tons pressure, four-column, upstroking hydraulic presses, twin rams 24⅜-in. dia. by 8-in. stroke, steam-heated platens 6 ft. 6 in. by 4 ft., table 7 ft. 6 in. by 4 ft. 2 in., working pressure 3,000 lb. per sq. in.

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Sixteen 200-ton ex-M.o.S. upstroke hydraulic presses, 10⅝-in. ram, 15-in. stroke, 6¼-in. columns, table 25-in. by 15 in., all-steel head, £875 each.

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Also other pumps, accumulators, etc., small presses one to 20 tons, control gear, etc. Hodson and Co. (Machinery), Ltd., Spring Mills, Tottington, nr. Bury, Lancs. Phone, Tottington 123-4. 192-38

ONE MARCYN FULLY-AUTOMATIC BRUSH MACHINE, new, list price less 20%. Box P917, care of "Plastics." 192-33

Machinery, Tools and Plant (contd.)

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400-ton upstroke press by Greenwood and Batley, 16-in. dia. ram by 28-in. stroke, four columns 20½ in. by 17¾ in. between, table area 3 ft. by 17½ in., daylight 3 ft. 5 in., W.P. 2 tons sq. in.

Two 250-ton upstroke presses by Henry Berry, 15-in. dia. ram by 20-in. stroke, four columns 2 ft. by 1 ft. between, table area 24 in. by 22 in., daylight 20 in., W.P. 1½ tons sq. in.

200-ton upstroke press by Iddon, 10⅜ in. dia. ram by 18-in. stroke, four columns 2 ft. 5½ in. by 10¼ in. between, table area 2 ft. 3 in. by 2 ft. 1 in., daylight 18 in., W.P. 5,000 lb. sq. in., fitted two electric platens each 2 ft. 2 in. square, daylight between platens 12½ in.

200-ton downstroke press by Hydraulic Engineering Co., D.A.-piston-type ram 11 in. dia. by 9¾ in. rod by 12-in. stroke, fabricated frame, table area 30 in. by 21 in., daylight 28 in., transfer ram D.A.-piston type 6¾ in. dia. by 6½ in. rod by 8-in. stroke, two ejector rams 21-in. dia. by 1⅝-in. rod by 7½-in. stroke, main drawback power 42 tons transfer ram 70 tons drawback 10 tons ejector rams 2½ tons total, drawback 4½ tons, self-contained pump and motor.

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150-ton downstroke press by Francis Shaw, 14-in. dia. ram by 26-in. stroke with two side pullbacks, four columns 28 in. by 12 in. between, table area 28 in. by 26½ in., fixed below base casting is an ejector ram and cylinder, daylight 28 in., arranged for pre-filling, W.P. 1 ton sq. in.

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75-ton upstroke press by Daniels, 8-in. dia. ram by 15-in. stroke, four columns 14½ in. by 9⅛ in. between, table area 17½ in. by 14½ in., daylight 23½ in., W.P. 1½ tons sq. in.

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MANCHESTER, 1.
Central 7081-2 and 1000. 192-35

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Raw Material Wanted (contd.)

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ERLANOS, LTD., 93 Aldersgate St., E.C.1 (Monarch 4686) require Perspex and cellulose offcuts and scrap, clear and coloured, highest prices paid. 192-3330

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POLYTHENE, natural, scrap, lumps, reground and virgin wanted. Please offer with samples and particulars to Herbert Connor, Ltd., 120 Beaufort Park, Falloden Way, London, N.W.11. 192-12

NYLON SCRAP, suitable for injection moulding, wanted. Box P9218, care of "Plastics." 192-11

DIAKON Red Ref. 403 and 400 required, virgin or scrap. Offers invited, Box P9214, care of "Plastics." 192-8

SITUATIONS VACANT

The engagement of persons answering advertisements in respect of vacant situations must be made through a local office of the Ministry of Labour, or a scheduled employment agency if the applicant is a man between the ages of 18 and 64 inclusive or a woman between the ages of 18 and 59 inclusive, unless he or she or the employment, is excepted from the provisions of Notification of Vacancies Order, 1952.

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EXPERIENCED PATTERN-MAKER wanted, apply giving details of experience to Thermoplastics, Ltd., Luton Rd., Works, Dunstable, Beds. 192-22

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(1). Chemist with Ph.D. or good honours degree and some years industrial experience.
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SALES DEVELOPMENT OFFICER, to work with technical department, a knowledge of rubber as well as plastics is desirable. Write stating qualifications to Rubber Improvement, Ltd., Rilex Works, London Rd., Wellingborough, Northants. 192-16

LARGE FACTORY IN KENT requires young man finished national service, experience in plastics, engineering training an advantage, for development laboratory. Box P922, care of "Plastics." 192-3

A LARGE MANUFACTURING ORGANIZATION with ample cash resources wishes to develop the extrusion and moulding of plastics, and is looking for a man to take charge of this development.
Applicants should have a sound knowledge of plastic materials and a good practical experience of extrusion and moulding processes. Some knowledge of reinforced plastics would be an advantage but not essential.
The starting salary will be commensurate with responsibility and this offers excellent prospects for the right man with technical knowledge, organizing ability, and drive.
Applications in confidence giving full details of experience and present salary to Box P923, care of "Plastics." 193-26

Situations Vacant (contd.)

PARTNER required in new two-man plastics project, with initiative, design and sales ability, capital and plastics knowledge of secondary importance in the right man. Box P9219, care of "Plastics." 192-x5452

MANUFACTURERS OF DISPERSED PIGMENTS require sales representative, having a technical knowledge of pigments, inks, etc., Slough factory, but can live anywhere convenient for nation-wide selling, good pay and prospects for successful applicant. Box P9220, care of "Plastics." 192-23

AN IMMEDIATE VACANCY exists for an assistant works manager, with sound knowledge and experience of both compression and injection moulding, with a well-established company in the London area. Applications, stating experience and salary required, will be treated in confidence. Box P9221, care of "Plastics." 192-24

TECHNICAL ASSISTANT required for moulding shop, previous experience necessary. Apply Box P9222, care of "Plastics." 192-36

MANAGER required for extrusion department of plastic manufacturers in north London area, experience on extruding polystyrene and handling labour essential, progressive position for young man. Box P9223, care of "Plastics." 192-15

INJECTION MOULDING. Wanted man possessing full technical knowledge and experience. Small modern shop. Prospects. Box P9224, care of "Plastics." 192-2

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SITUATIONS WANTED

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THE THEORY OF POLYMERIZATION, by H. R. Fleck, M.Sc., F.R.I.C. Full explanation in simple language, with examples, calculations and exercises of this fundamental aspect of the chemistry of plastics. Illustrated. 144 pages. 10s. 6d. net from booksellers, or 11s. by post from the publishers, Temple Press Ltd., Bowling Green Lane, London, E.C.1. zzz

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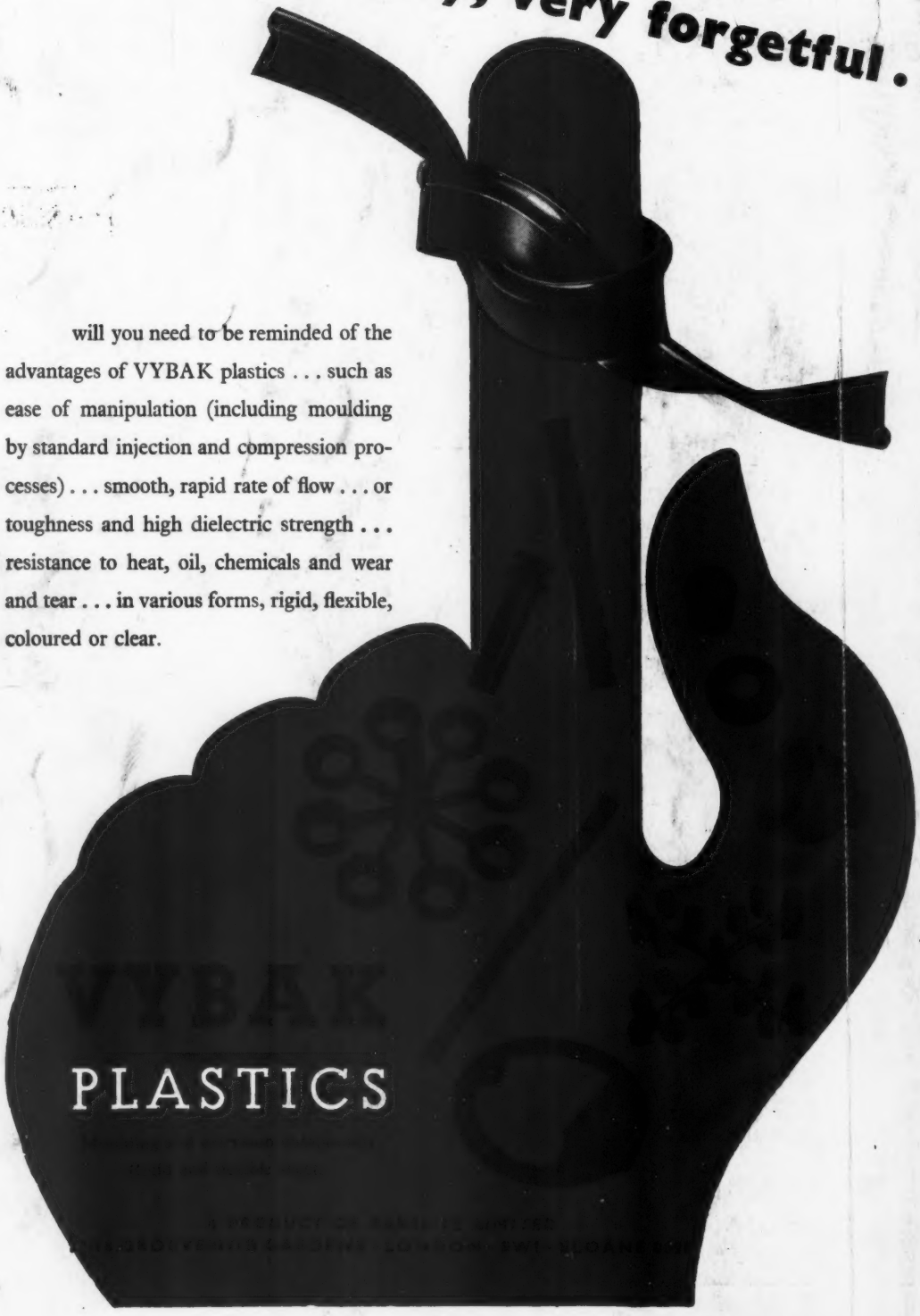

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